

2a

2/p/cm/147

HOUSE OF EDUCATION, AMBLESIDE.

NAME K. Hugman

DATE May 8th 1922 ~~FORM~~

SUBJECT Botany & Natural History

E. S. A., LONDON.

Cmc 147

ilp2 cmc 147

Botany

Cruciferae (cross-bearing family)

Characteristics

Cruciform flower

in Botany Bk.

Tetradynamous stamens.

Fruit, a silique.

May 18th '22

The Horse chestnut leaf consists of 5 or 7 leaflets springing from a common basis. Each leaflet is oval (shaped) & pointed slightly at the apex. The margin is indented - pointed teeth.

The Rose leaf consists of a number of leaflets (generally 5, 7, or 9) springing from different parts of the stem. They are pointed & widen towards the base & curl in again. Each has very pointed teeth.

The ~~shape~~^{margin} of the dandelion leaf is described as serrate. It has a rounded top & has two large rounded teeth on each side, &

a broad base.

The beech leaf is ovate in shape - almost a heart upside down. Its margin is slightly indented with blunt teeth. It is also covered with silky hairs.

The daffodil leaf is linear - that is, its two sides are parallel, & its margin is entire.

9. The ivy leaf is tri-lobed - each lobe is pointed & the margin is entire.

Page 231

June 9th '22

Hypogynous flowers (1) Wallflower, Rhododendron.

Hypogynous, but flattened receptacle (1) Bird's Eye

Perigynous (5) Poppy, figwort, apple

Epigynous Cow parsley, Daffodil.

Whorls arranged spirally

Internodes between calyx & corolla

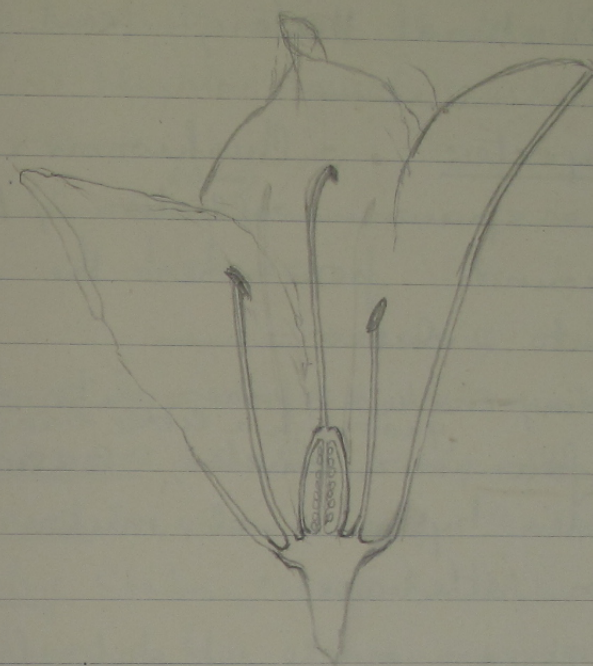
corolla & stamens

Trimerous Lily of the Valley

Pentamerous Primrose, Camphor

Tetramerous Wallflower In twos

odd Sepal anterior Broom



Longitudinal Section of Rhododendron.

Stamens opposite petals:

Absence of perianth: Willow

One whorl of stamens: Primrose

More than two: Ranunculaceae.

Very fair

Cont. in Botany Book.

Natural History. (cont. from other end)

Hyphomycetes - Mushrooms & fungi.
 Mycelium or spawn - ^(web) collection of threads at
 base - in ground - from where the fungi spring.
 Divided into 2 classes:-

1. Those bearing naked spores like cherries -
 generally four in a cluster, ^{growing on a little base} - Basidiomycetes
 [Hyphomycetes: hyphae - a web, mukes - a fungus]
 Gk. basidion. little base.

Fungi are made up entirely of little
 threads. Parasitic or Saprophytic.

2. Ascomycetes - gk. ascos - a wine skin.
 eg. Penicillin

Basidiomycetes are divided into 2 classes
 - Hymenomycetes & Crateromycetes. The
 former ^{have the} spore bearing ^{membrane} ~~part~~ exposed
 during development. (gk. humen - a membrane) /

The latter it is enclosed - (from gk. gaster.)
 eg. ~~Penicillin~~ ^{eg. Sclerotinia, Sclerotinia, Ruff ball}
 Spores are born on gills, in pores or
 on teeth. Species may sometimes be distinguished
 by colour of spores - white, black, brown, purple, red
 & pink.

Smuts & rusts - e.g. cluster cups.

Moulds & blights - much simpler.

Good but unsightly

LichensJune 26th

Lichens are divided into 3 main groups:-

1. Crustaceous. *Leccidea lucida*; *Leccidea geographica*; *Graphids* or letter-lichens.
2. Foliaceous. *Physcia parietina* (yellow). *Parmelia saxatilis*; *Peltigera* *Canina*.
3. Shrubby. *Cladonia*; Old Man's Beard lichen.

Lichens differ from mosses in not having
 leaves or stems. Their place is taken by a
 thallus. Lichens have a dull appearance
 which contrasts strangely with a name which
 meant originally 'full of life'.

Each 'dot' or reproductive organ is called an
 apothecium. *Leccidea lucida* is like dust. *L.*
geographica is bounded by black lines & has
 a number of black dots resembling towns. &
 when patches join together, the black outlines
 resemble counties. The Apothecia of the *Graphids*
 look like Eastern letters.

Cladonia lichens: 'cup moss' lichen & reindeer moss.

There is a theory that a lichen is a mixture of fungus & alga, ^{the first} ~~then both~~ parasitic & dependent on the other. This may be so, for it is quite true that a lichen can grow where neither a fungus nor an alga can grow by itself. But this theory is still under discussion.

There are 3 modes of reproduction:-

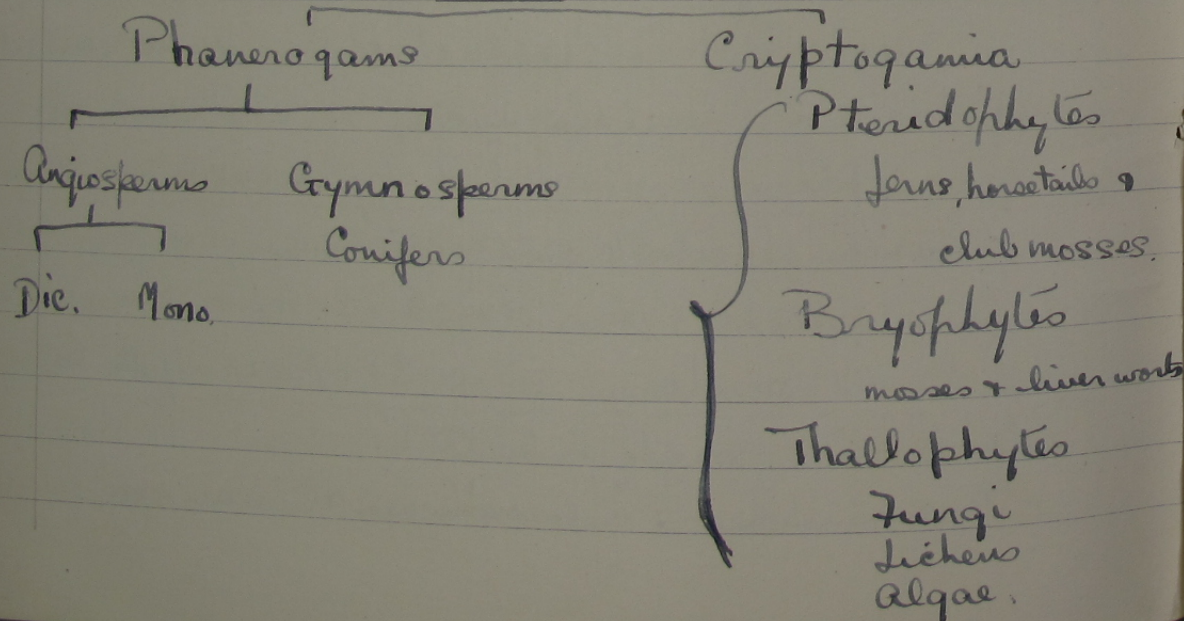
1. by Spores - squeezed up on to the coloured surface by the sterile cells.

2. by soredia

3. by fragments. Good but the writing needs improvement

Algae.

July 3rd



Algae vary greatly in size - as a group. Some are microscopic, others reach great size. Unlike other plants they do not possess vascular bundles - or true roots, leaves or stems.

Whole plant body is a ~~thallus~~ thallus. A great proportion of the algae are seaweeds. These are classified according to their spores, which are the same colour as the seaweed itself - green, brown & red. Brown grows between high & low water so that it is not long out of water. The red is never out of water, as it cannot grow except in the water. It is seen that the colours are, according to the plant's relation to the light. The green ~~algae~~ has therefore, the greatest amount of sunlight.

Diatoms are useful for testing microscope lenses. They are very slippery. Many algae are found in fresh water, such as Desmids.

Other ~~the~~ groups of Algae are -

1. Blue-green algae, which are red, & give the colour to the Red Sea

2. Green algae.

Green laver - one of the Conjugatae, looks like lettuce.

Chara (Tarn Haws)

Spirogyra

Diatoms & Desmids - (one-celled)

III. Brown Algae

Fucus or bladder wrack

Laminaria or seaweed

Sargasso weed

IV. Red Algae

Delesseria

Placodium

Dispersion of Seeds

Oct. 16th

By Mechanical means -

balsam

violet

Broom

herb roset

lesser hairy capsule cress

wood sorrel

squirting cucumber

By wind

Wings

fruits

seeds

Sycamore

pine

Maples

fir

ash

larch

hornbeam

honesty

elm

birch

Umbelliferae

lime

Pappus

fruits, seeds

dematis

willow

dandelions

willow herb.

other
Compositae

bulrush

cotton grass

marsh valerian

kumble weeds

long stalked capsule: ex. poppy.

campion.

Birds or Animals

Hoofs

bullock

goosegrass

avens, houndstongue

teasel

agrimony

enchant's nightshade

wood sanicle

foetida melick medick

forget-me-not

fleshy or edible.

hips

blackberries

raspberry

haw

cherry

holly

stoe

apple

hazel

beech

chestnut

acorn.

seed

walnut

sticky

mistletoe.

R

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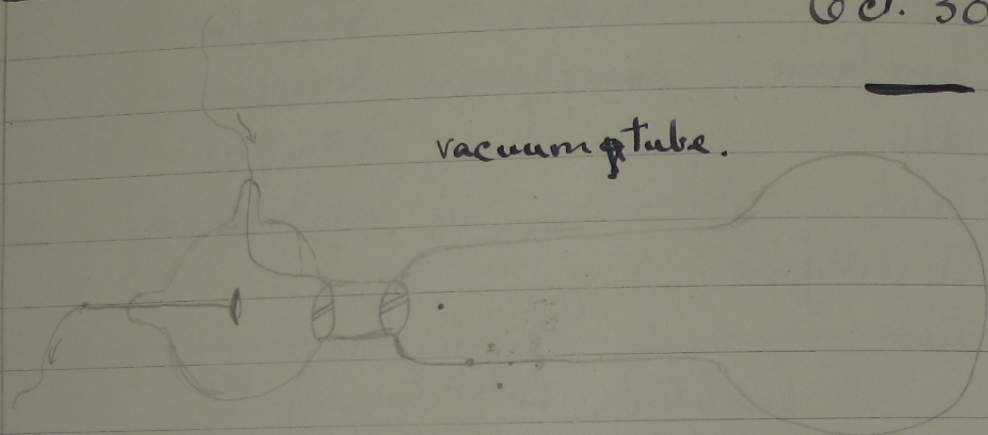
New Red Sandstone.

Oct. 17th

Found on top of the Carboniferous rocks.
Buildings: - Carlisle, New Liverpool Cathedral

Oct. 30th

vacuum tube.



Sir William Crookes

The bombardment of electric ^{particles} atoms passing through the further end of the vacuum tube is called cathode rays or electrons. The particles are shot off from the metal & travel in a straight line to the bulbous part of the tube & make it phosphorescent. If a magnet or other drawing force be placed beneath the tube, their course is deflected downwards. If a cross or

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something to that effect be placed in the narrow part of the tube, its shadow will be seen on the bulb as the electrons have passed by the arms of the cross but naturally could not pass through it. Also, if a small windmill or vane be placed inside the tube the high speed of the electrons causes it to turn. If a window of aluminium foil be placed in the bulb the electrons pass out through this & make the air outside luminous, but the air outside has too great a force to let the electrons go farther than an inch or two away.

Electrons move at an enormous speed - varying from 5,000 to 60,000 miles per second. (Light = 186,000 m.p.s.)

Radium is the heaviest but one of the elements. It was discovered in 1898. Three kinds of rays are given off by radium. The first two kinds are thought to be forms of matter. The third are X-rays.

1. 18,000 m.p.s. on striking certain matters they give off tiny sparks of light. twice as big as atom of hydrogen.

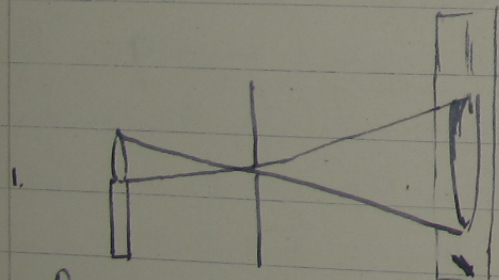
2. Usually called electrons & help us most in discovering the composition of the atom. 1000 times smaller than an atom of hydrogen.

There is some force holding the electrons together to form the atom. (e.g. force of gravity & solar system.) This may be shown by experiment - with ^{large} magnet & several small ones in water drawn together to form shape according to number.

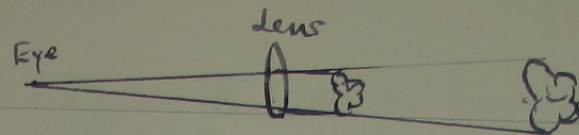
Light.

Nov. 13th

1. Light travels in straight lines
2. " can be refracted
3. " " reflected
4. " travels at a ^{velocity} speed of 186,000 m.p.s.



2. Rays are bent when they travel through denser mediums. Lenses etc. e.g.



Eye or mind expects a straight line. Light causes vibrations in the ether (waves).
 → wave length → ray of light.

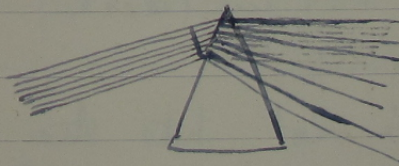
Longest ether waves are the electric ones. Shortest one is ^{wh. has been used} $\frac{1}{6}$ inch. These are of course enormous to the ordinary rays of light.

$\frac{1}{30,000}$ " = dark heat which we can only feel.

White light consists of 7 colours. They vibrate at different velocities - e.g. ^{some} wave lengths are longer than others.

$\frac{1}{34,000}$ " red waves, $\frac{1}{6,000}$ violet waves

There is also ultra-violet light which cannot be seen. X rays ^{have an} are even smaller ^{wave length} than this. Red, orange, yellow, green, blue, indigo & violet.



Red are slowest, violet the fastest. Shortest ultraviolet wave measured = $\frac{1}{10,000}$ of a mm.

R

3. Reflection. Some colours attract light & others absorb it. Every colour is begun by the electrons in the molecules

Sound.

Dec. 4th

Sound.

Light

Vibrations in air
 $\frac{1}{5}$ m. p. s. or 1 m. in
 5 sec. (roughly)

Vibrations ⁱⁿ of aether
 186,000 m.p.s.

Sound is transmitted much more clearly through solids than just air. (also water) Wood iron. Most gases transmit sound as well as ordinary air. Water, 4 times as fast. Iron 15 & Wood 10.

Molecules act like trucks on a railway line - For instance

- each successive lot hits the next & gives it a push on. Wave length is measured from one region of compression to the next

(Different wave lengths).

In light - Colour depends on wave length

In Sound - Pitch depends on wave length

6 1/2 ft long & 16 in a sec. (lowest we can hear)

1/3 inch long & 38,000 per sec. (highest)

Shorter the wave, higher the pitch.

87 per sec. lowest in man's voice

768 - highest - woman's

Vibrations of regular length & evenly, produce musical sounds.

String vibrating -

1. as a whole - produces the Fundamental note
2. in halves - .. octave to F.
3. in thirds - .. fifth to no 2.
4. in quarters - .. two octaves to F.
5. in fifths - .. major 3rd to no 4.

also similarly higher up.

gases transmit

Spring Term 1923

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Classes of the animal Kingdom

1. Protozoa - { Protos = first
 { zoön = animal
 unicellular, microscopic forms
2. Coelenterata - { Koilos = hollow
 { enteron = intestine
 Jelly-fish, Sea anemones etc
3. Echinodermata

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Jan. 29th

The Protozoa are more or less Protoplasm. (Protos - first & plasma - form) Nothing can live without protoplasm. Protoplasm multiplies by splitting in two at the nucleus. Every cell is filled with protoplasm.

Amoeba are about the simplest protozoa. They live in muddy ponds. Also Thread slimes - Rhizopods. These have no definite shape or mouth. Infusoria have a more or less definite shape & mouth.

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Autumn Term 1923. Astronomy.

@ October 2nd

Apparent motions of the sun:

rising & setting

length of days & nights

Seasons

Climate

- Earth's rotation

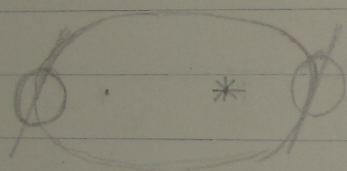
- Earth's revolution in

orbit & inclination of

axis. Distance from

sun.

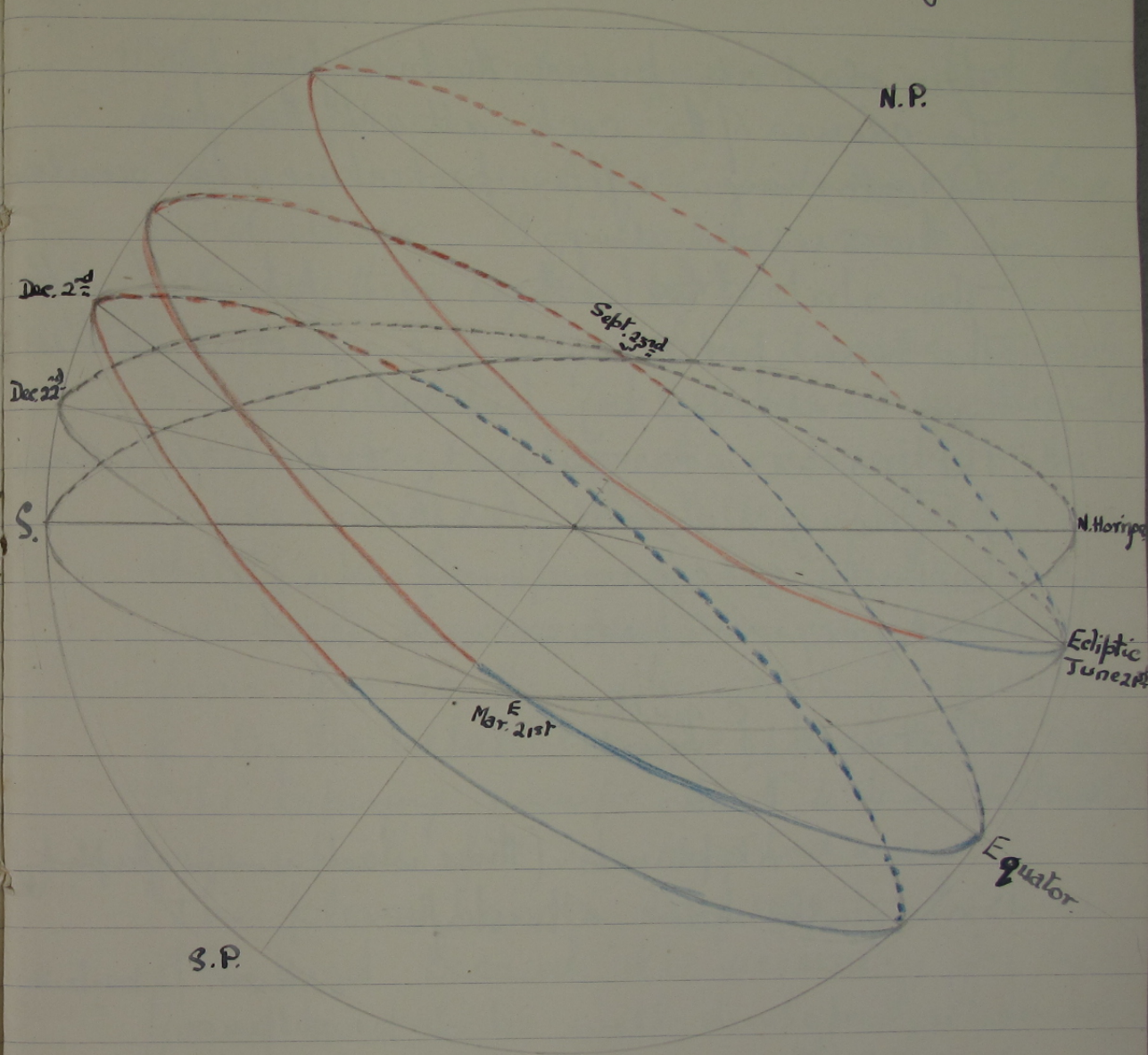
Southern summer is hotter than northern summer - the sun is in 'focus'.



The ecliptic is the plane of the Earth's orbit or the apparent path of the sun.

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Celestial Sphere for an observer at a latitude of 54° .



— Day
— Night.

V. G.

but the partridge can afford to have small eggs because she is more like a hen & is prepared to take more care of her young than is a snipe.

A Guillemot is ~~as~~ the size of a raven, but its egg is about 10 times as large. This egg is the size of that of the eagle - which proves that the eagle's egg is small comparatively.

4. Birds of prey
5. Perchers - (half of all the known birds)
6. Scratchers - partridge etc.
7. Climbers - eg. woodpeckers, nuthatch.

Two divisions into which all birds may be divided are those with

1. a keeled breast bone - flying birds &
2. a raft-like or flat breast bone - running birds (ostrich, emu, Rhea, moa etc)

V.9.

Astronomy.

Oct. 16th '23

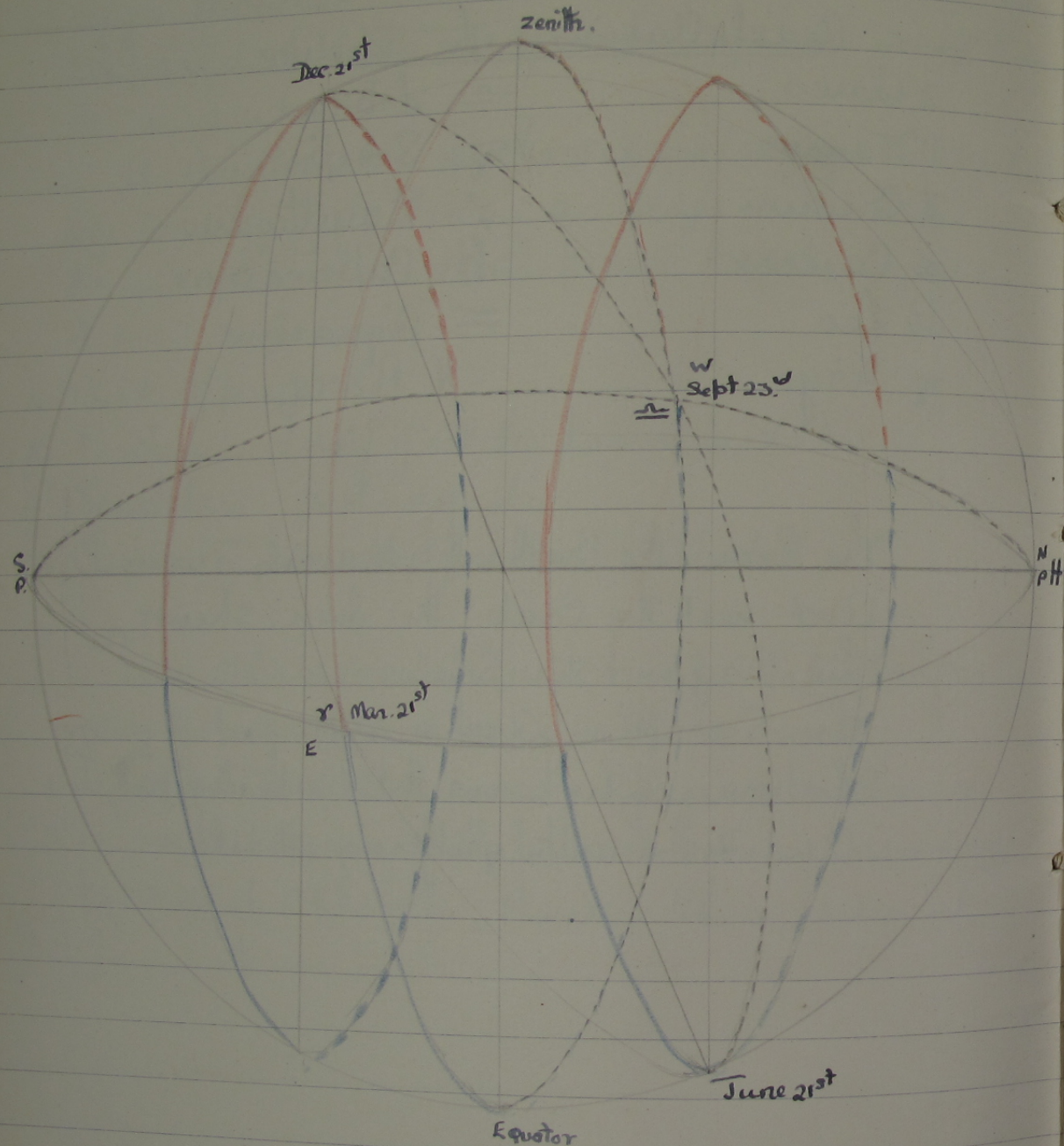
Constellations in the Zodiac.

♈ Aries	♎ Libra
♉ Taurus	♏ Scorpio
♊ Gemini	♐ Sagittarius
♋ Cancer	♑ Capricornus
♌ Leo	♒ Aquarius
♍ Virgo	♓ Pisces.

The Ram, the Bull, the Heavenly Twins,
And next the Crab, the Lion shines,
The Virgin & the Scales,
The Scorpion, Archer & the goat
The man who bears the watering pot
And Fish with glittering tails.

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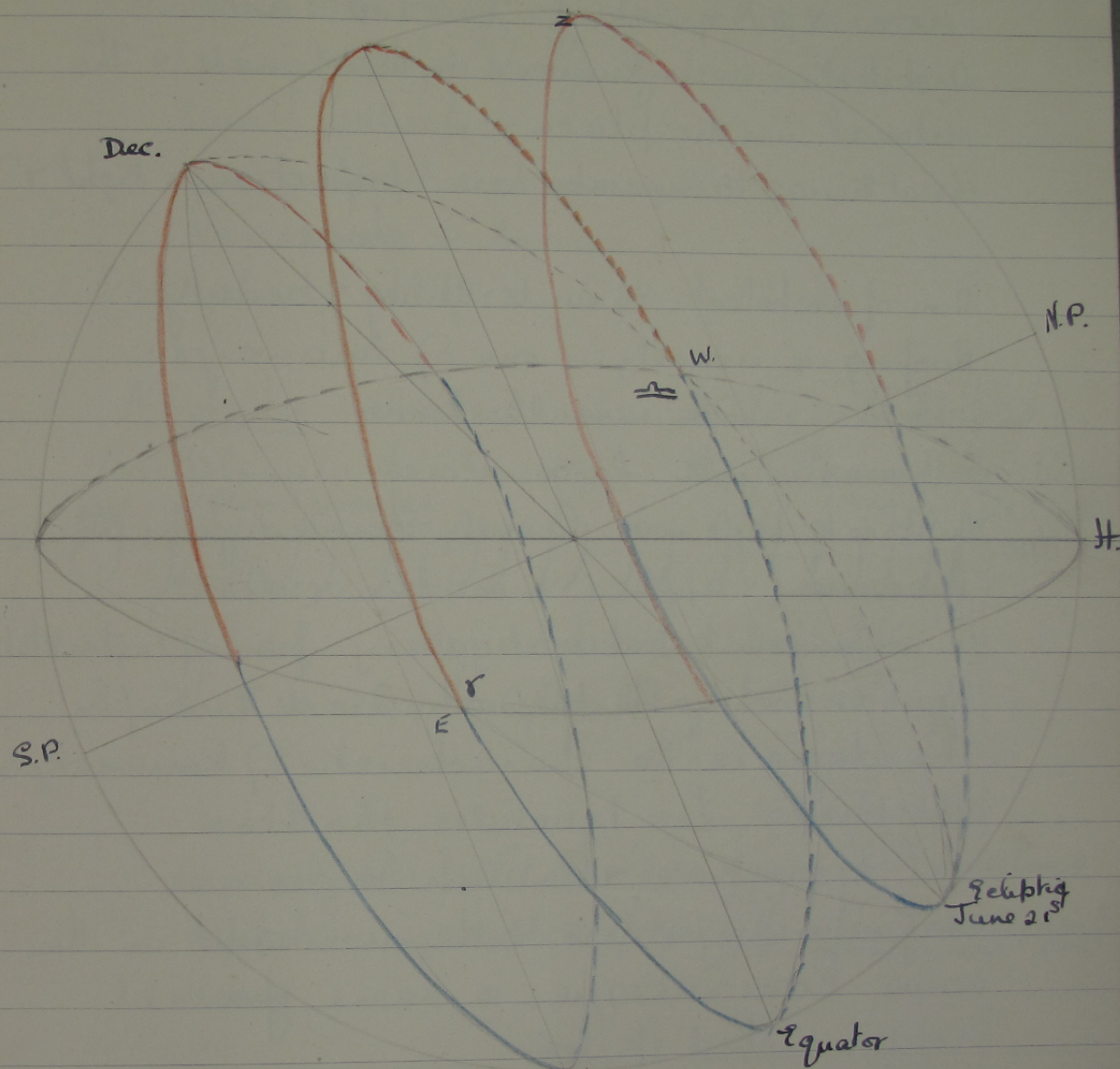
Celestial sphere for an observer at the Equator



Days & nights are equal; sun is always overhead.

i/p 26 cme 147

Celestial Sphere for an observer at the Tropic of Cancer



V.9.

Architecture

Oct. 22nd

From ἄρχη = chief τέκτον = art.

Architecture is influenced by the climate & the material in the place.

Great things to remember are: proportion; light & shade.

Aim of architect: to unite utility & beauty.

Roofing is usually in one of two ways:

1. Arches - with small stones

2. Beams - with large stones.

I did not say this? The Greek style was largely derived from the
Tuscan, & applied to vaults & doors.

ex. in London: National gallery, front of Euston station.

Roman arches: Marble Arch, Arc de Triomphe.

The dome is the characteristic of Roman style.

St Paul's, Les Invalides, Pantheon.

Byzantine & Roman styles are contemporary & are both included in the name Romanesque, a name for all round arched styles.

In England now there are chiefly either Saxon or Norman.

The Saxon is the earliest native style & there are very few remains. What there are, are mostly towers. The chief characteristics are:

Triangular headed windows in towers

Small balusters

long & short work in angles.

Narrowness & lowness.

[Old church at Ripon 670 a.d.]

Norman Oldest church in London is that of St.

Bartholomew the Great.

Barfreston nr. Dover is Norman 1000 a.d.

(Semi-circular Round-headed) arch


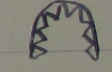
Pillars - solid

Windows - round-headed, thick walls

Three divisions from floor to roof: Clerestory

Triporium

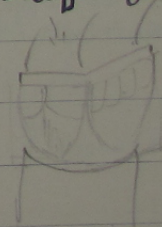
Nave arcade.

Ornaments: billet  or zigzag  mouldings.

capitals - square blocks of stone with cushion underneath (cutting corners off a square block)

doors

Good but the drawings are too sketchy



i/p 29cmc 147

Astronomy

@ Oct. 23rd '23

Moon's diameter = 2,000 miles.

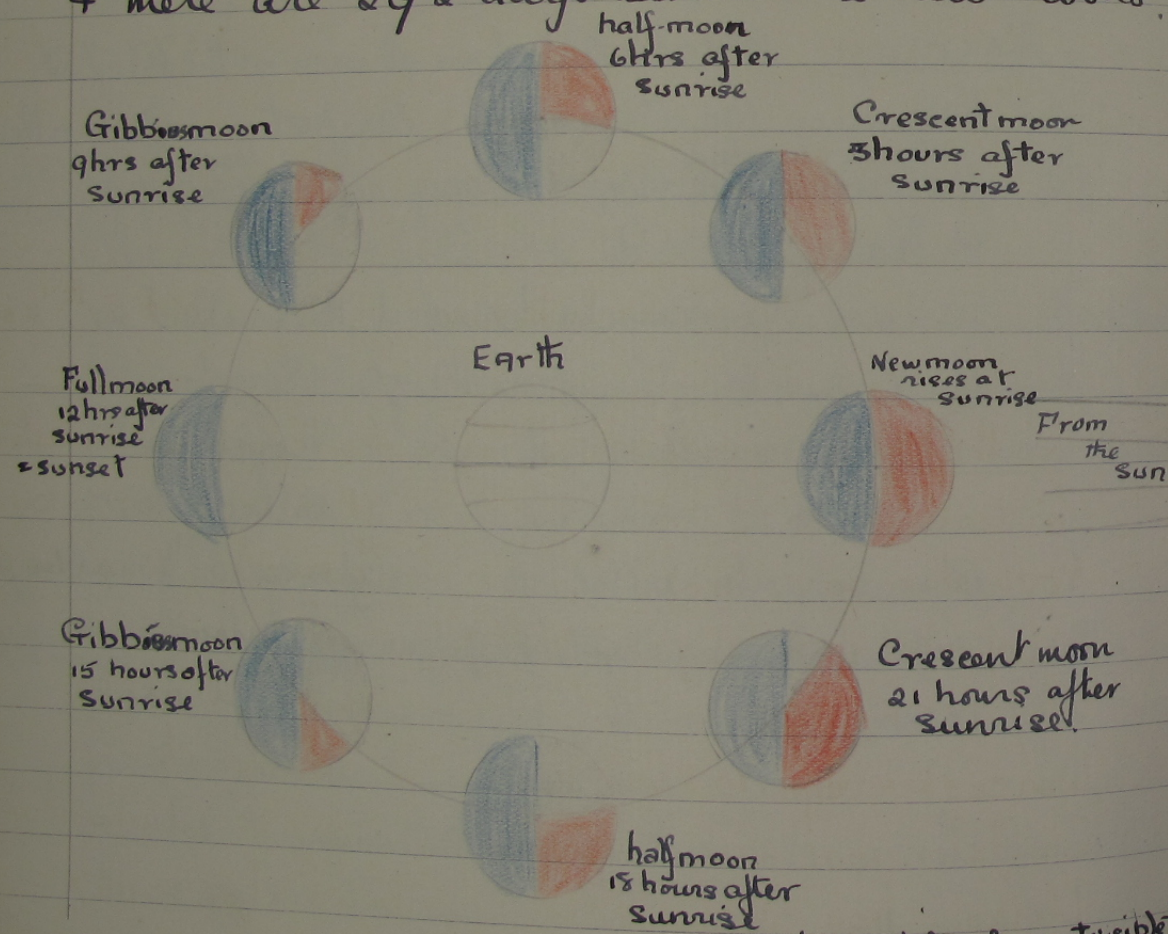
240,000 miles from the earth.

Moon's light is reflected from the sun.

New moon rises with the sun.

Full moon rises at sun-set.

The moon takes 27.3 days to go round the earth,
& there are 29½ days between 2 new moons.

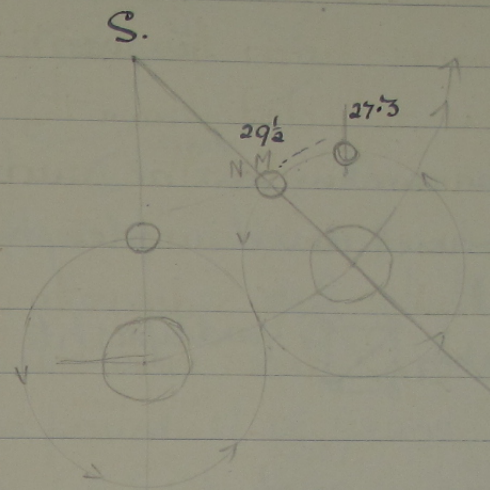


Phases of the moon. Key to diagram:

illuminated surface not visible to earth
darkened surface of moon

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Moon's rotation in one month - same as time it takes to go round the earth.



Showing why there are 29½ days between 2 new moons.

Good. The big diagram is injured by crowding

Architecture

Oct. 29th '23.

Cathedrals 1060-1145 or 1170

Churches of Benedictine Monasteries

Canterbury 1072

Rochester 1077-1137

Winchester 1079-1093

Ely 1081-1103

Worcester crypt 1084

Chichester 1091-1114

Durham 1104-1123

Norwich 1096-1101

Ereket towers 1107

now cathedral

St Albans 1077-1093

Gloucester 1080-1100

Peterborough

Southwell 1130

Abbeys etc.

Bury St Edmunds

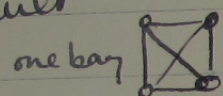
Tewkesbury 1107

St Bartholomews 1123

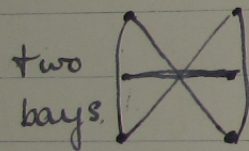
Abbeys etc *ilp31cmc 147*

Romsey
Christchurch 1050
Wimborne 1043
Tunness 1090.

Earliest Norman vaulting was at Durham.
Simple groined vault. "plough share".
Ribbed vault



quadripartite vault.

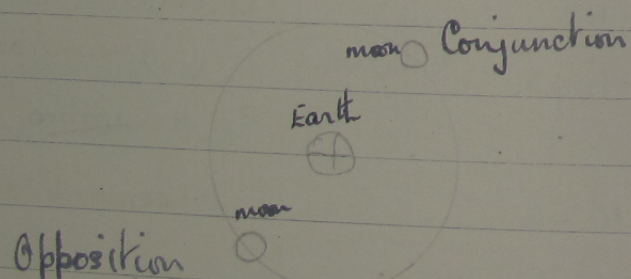


sexpartite vault

Astronomy

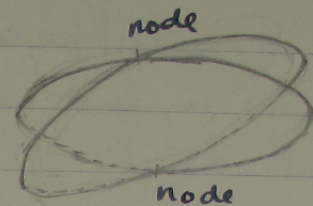
Oct. 30th '23

Sun



ilp32cmc 147

5° angle made by the moon's orbit with the ecliptic.



^{total}
An eclipses occurs only at the nodes. As the nodes are always ^{total} shifting, eclipses of either the moon or sun are rare.

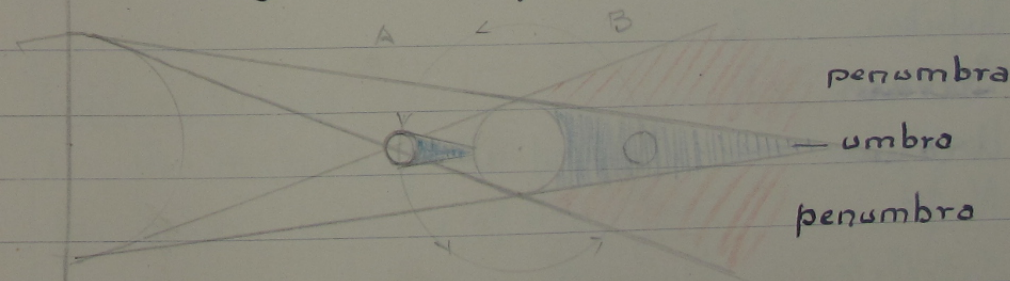
The Saros is a period of 18 years or 223 lunar months or $6585\frac{1}{3}$ days. - cycle of eclipses.

During this time there are 45 solar & 25 lunar eclipses.

There must be 2 eclipses in a year & may be 7.

Three kinds of solar eclipse: Total, Partial & Annular.

Diagram showing the Eclipses. A of the sun B of the moon



The penumbra receives light from (one) part of the sun only.

An Annular eclipse ^{takes place} is when the moon is apparently smaller - i.e. is farther away from the earth (orbit ellipse is an ellipse) & it is not apparently large enough to cover the entire sun, but we may see a ring of the sun outside it.

Good



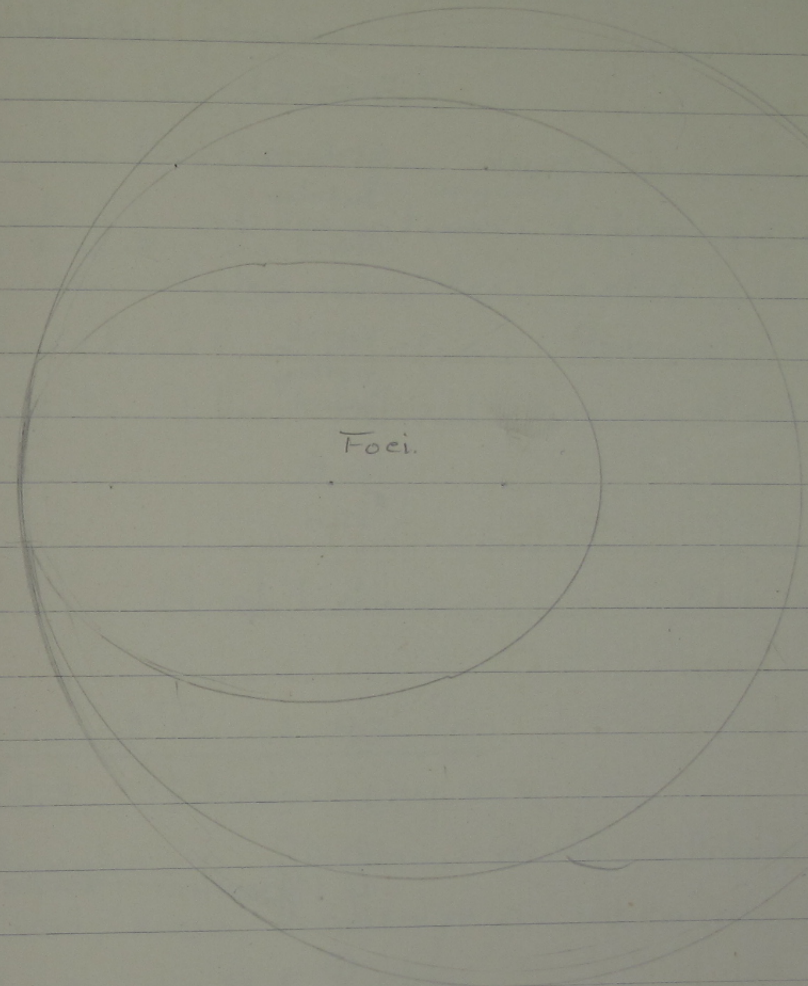
Astronomy.

Nov. 6th

The Solar System

Mercury	♂	} Inferior planets. (between earth & sun)
Venus	♀	
Earth	⊕	
Mars	♂	
Asteroids		
Jupiter	♃	
Saturn	♄	
Uranus	♅	
Neptune	♆	
Satellites	Comets	
	Meteorites	

Ellipses.



Kepler's Laws.

I The orbits of the planets are ellipses with the sun in one of the foci.

Position of Planets according to P. ~~to~~ Ptolemy 100-170 AD.
(2) Copernicus 1473-1543.

Stars.

Saturn

Jupiter

Mars

(1) Sun (2) Earth

Venus

Mercury

(Moon)

Earth

(1) Sun

4 Opposition (Superior planet)

⊕

♀ Inferior Conjunction

♂

♀ Superior Conjunction

4 Conjunction

Planets move

shine by reflected light.
have phases.

Inferior planets transit.

Tycho Brahe d. 1601 made an enormous amount of observations ^{for 20 years}. Kepler (1571-1630) was his pupil & he made use of his master's notes & by "mathematical deductions discovered that the orbits of the planets are not circles but ellipses."

Good

Architecture

Nov. 12th '23

Transitional Period 1145-1190

: Bristol; Glastonbury. 1184


Characteristics: interlacing arches; elaborate decorations; many mouldings on one arch; pointed as well as rounded arches.

1174 Canterbury Cathedral by William of Sens. Noyon, Soissons & Sens Cathedrals are very like Canterbury.

Corinthian capitals; pointed arches; vaulted shaft springing from top of pillars ^{instead of round}; sexpartite vaulting; (abacus square)

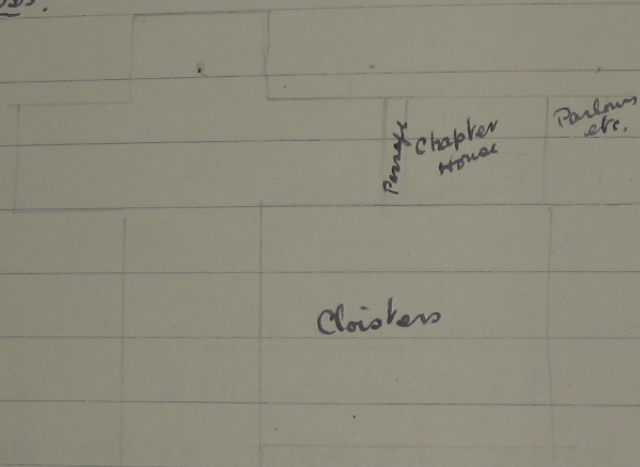
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paired ^{columns} capitals: French characteristics in
Canterbury: Very English is the Purbeck
marble for decoration; narrowness in width;
zig-zag moulding.

Carlisle 1188 has a strange tower arranged
upon ^{by} 2 squares:  Also an ~~arcade~~
continuous arcade, which has had to be propped up by
2 stones.

Furness:

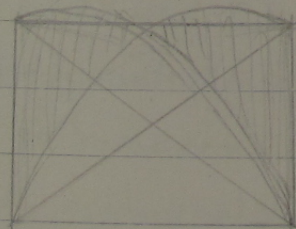
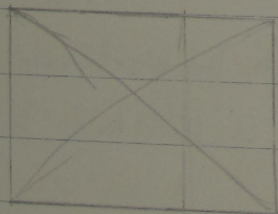
1147.



Cloisters

[Mont's dormitories
over Chapter House]

twisted groin



playhouse

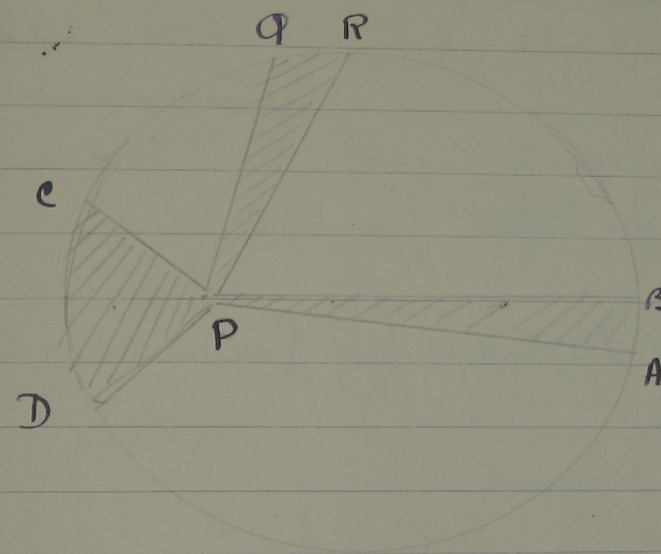
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Astronomy

Nov. 13th 23.

Earth moves at 18 m.p.s. Diameter of its orbit ^{million} 186 miles
Line joining the a planet to the sun is called
the radius vector.



Kepler

II A line joining the planet to the sun sweeps
over equal areas in equal times. i.e. from
A-B; C-D; R-Q.

III The squares of the periodic times are proportional
to the cubes of the mean distances.
for instance taking Earth & Venus
 $(365.3)^2 : (224.7)^2 :: 1 : (0.7233)^3$

1781 - Uranus - Herschel

ilp39cmc147

Jan. 1st 1801 - Ceres discovered by Piazzi in Sicily.

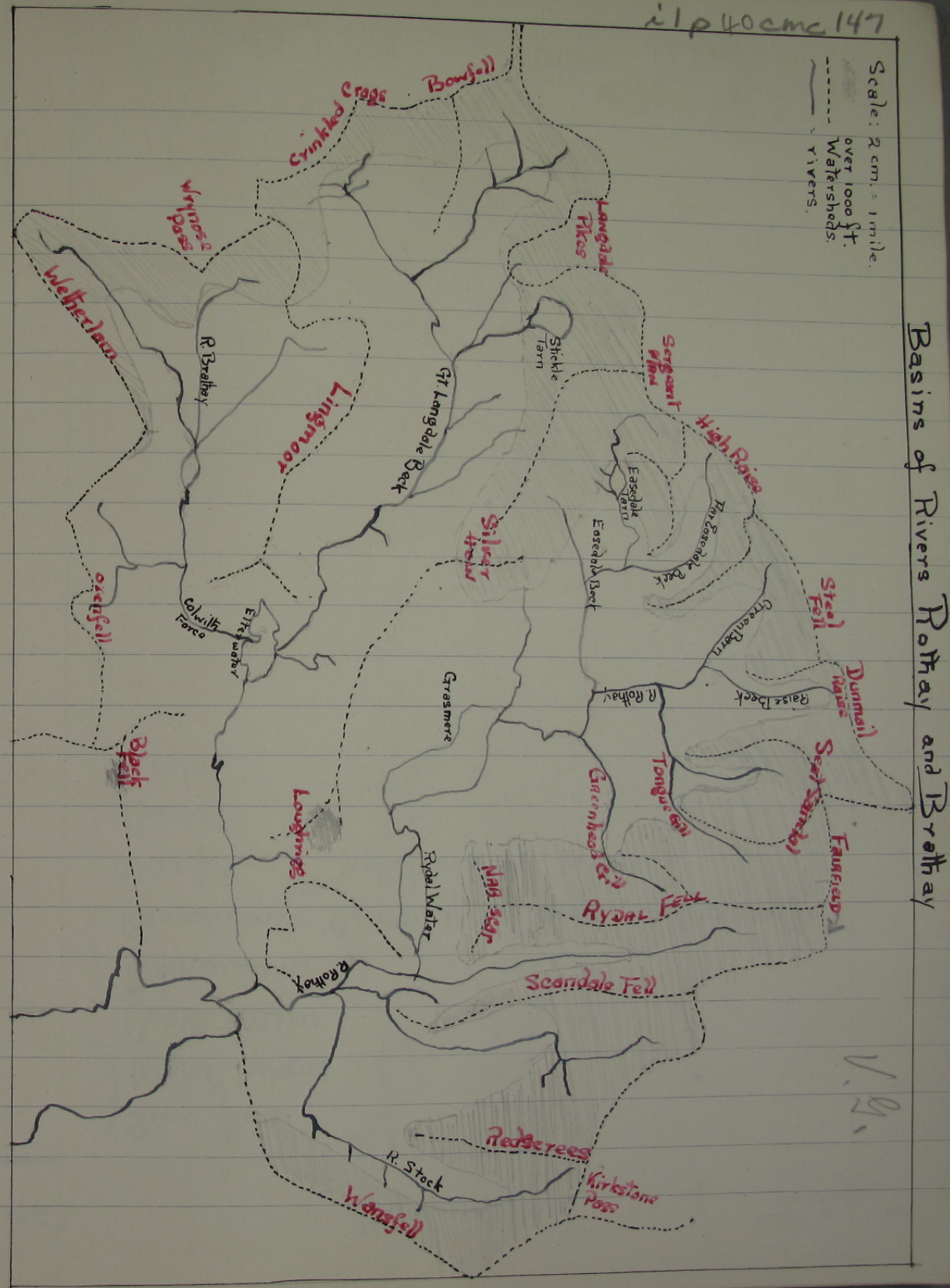
Bode's Law holds good except for Neptune.

Earth								Uranus	Neptune
0	3	6	12	24	48	96	192	384	
$\frac{4}{4}$	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{4}{4}$	$\frac{4}{4}$		4
4	7	10	16	28	52	100	196	388	300

If 10 represents the earth's ^{distance from the sun} then Uranus is $\frac{196}{10}$ of the earth's ^{distance} from the sun.

1846 - Neptune by Le Verrier & Adams. *FL*

ilp40cmc147



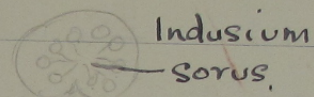
Natural History

Cryptogamia - from Kruptos - hidden & gamos - marriage.

Ferns are Vascular Cryptogams or Pteridophyta.

Fronds are divided into pinnæ & those into pinnules.

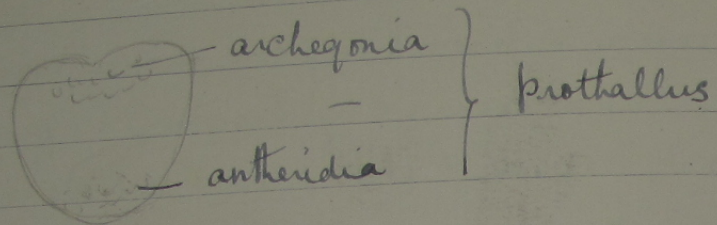
The Indusium is an umbrella-shaped cover over the sorus - or heap of spore-cases. The Sporangia (ion) or spore cases hold the spores.



On the Prothallus there are antheridia - or vessels holding the sperms & archegonia - or vessels holding the eggs. The only way in which a spore resembles a seed is that it is cast away from the parent plant to begin life on its own ^{account}. The spore subdivides & forms a prothallus and fertilization comes afterwards. In the flowering process fertilization comes first. The archegonia when fertilized produce a fern-plant. The sperms float down on any drop of water to the mouth of the archegonia, holding the eggs. Generally, the nourishment contained on the prothallus is sufficient only for the

i/p 42 cmc 147

development of one egg.



Special Spore-bearing fronds. -

Parsley Fern

Osmunda (Royal)

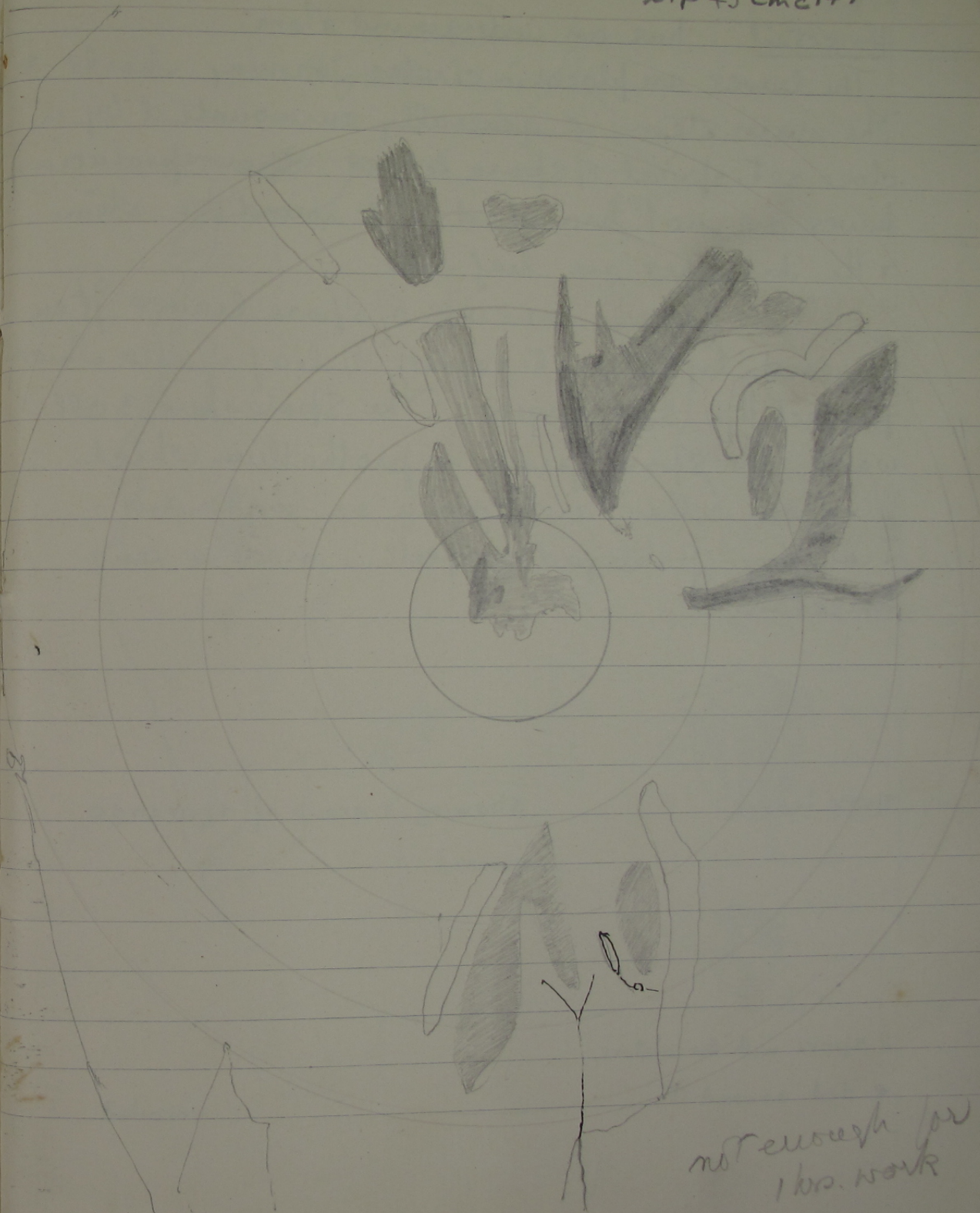
Hard Fern

Adder's Tongue

Moonwort.

Y.G.

i/p 43 cmc 147



ilp44mc147

Horsetail - has an underground stem.

The leaves are placed in circles forming whorls *
The main stem is generally surmounted by a
close set spiral of spore leaves. Spore-producing
leaves are not branched. * round the stem
the branches are leaf-like.

The 'flower' consists of spore leaves often
covered by several series of leaf-whorls which
protect the sporangia. The spores have 3 cell
walls. The spore forms a prothallium which
produces either archegonia or antheridia.
From the fertilized egg cell is made a new
horsetail.



spore leaves.



showing a group of sporangia.



A spore with the elaters
coiled around it.

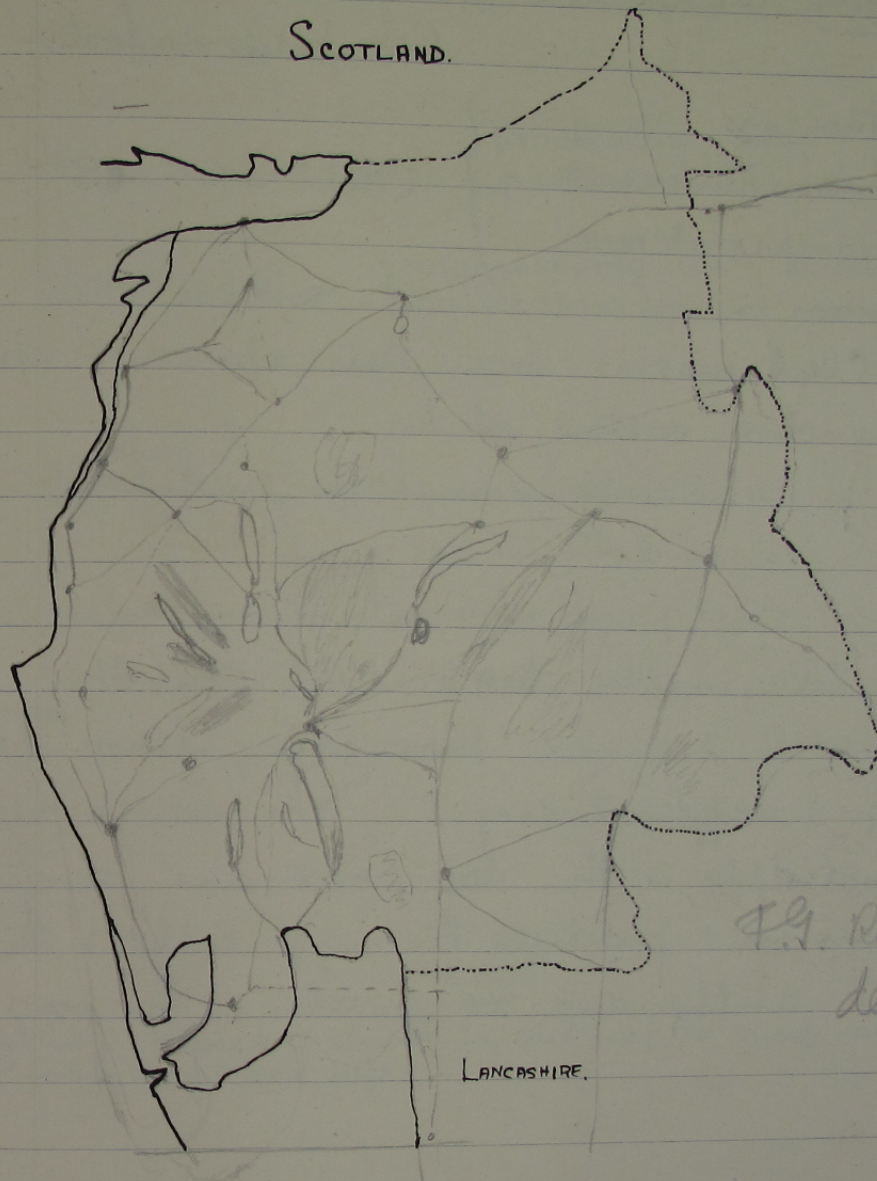


uncoiled.

V-9.

ilp45mc147

SCOTLAND.



LANCASHIRE.

P.S. Roads want more
definite lines

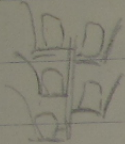
May 22 '22

Club Moss - Lycopodium - Lykos - a wolf
Pous, podys - a foot Gk.

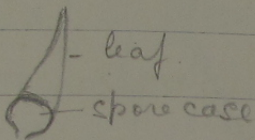
ilp 46 cmc 147

L. Clavatum or
Stag's horn club moss
L. Selago - fir club moss
L. alpinum } Club mosses

Club mosses bear their spores on special
little branches called clubs.



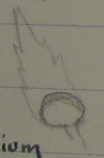
Longitudinal section
of cone of club moss



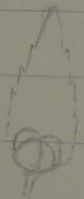
leaf
spore case

The Selaginella ~~has~~ or Little Club Moss
has spores of 2 sizes proceeding from spore
cases of 2 different sizes. The lower cases
are quadruple & the top ones are single
The lower ones produce the egg cells & the top
ones the antheridia ^{those sperms} to fertilize the egg cells
This has been found out from tropical plants & usually is carried on
after spores have fallen to ground

micro-sporangium



macro-sporangium



Selaginella
Longitudinal section of
Cone of Selaginella

Ferns

Club Moss

Spore, prothallus } male
female

ilp 47 cmc 147

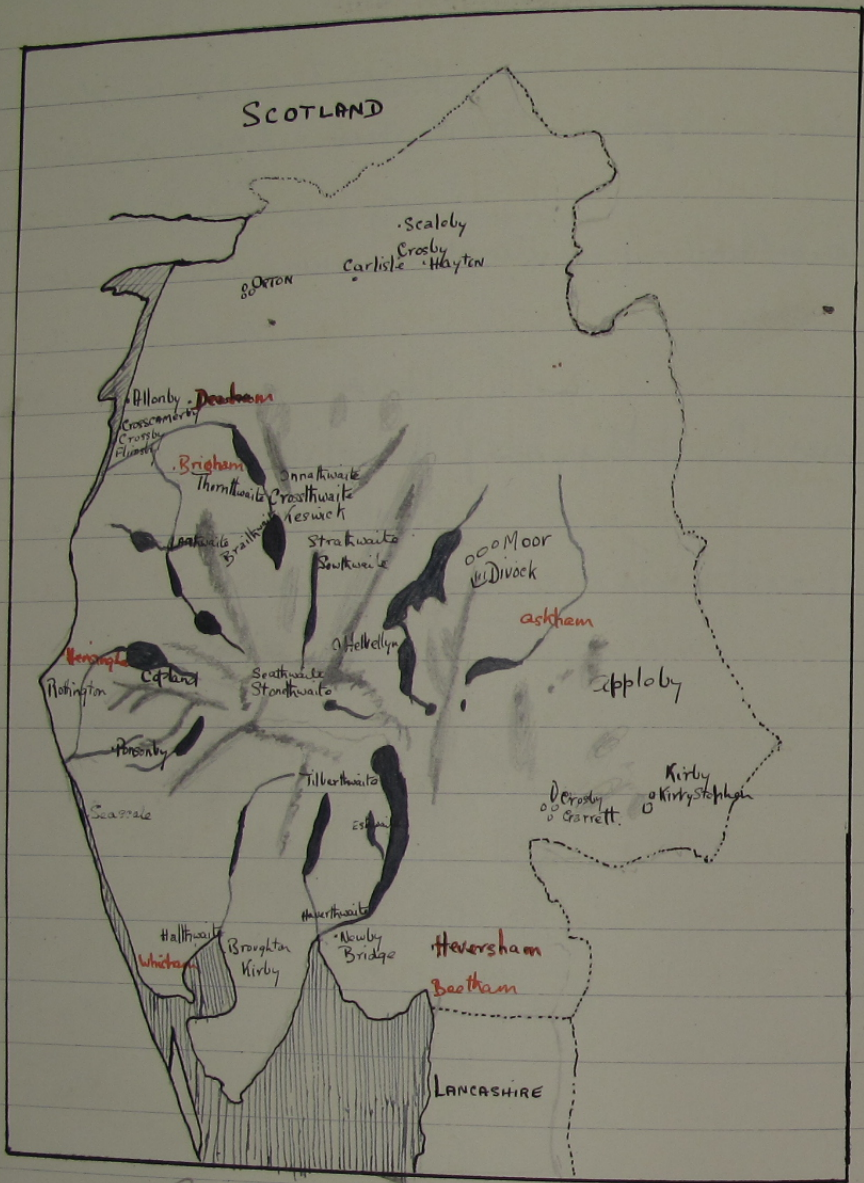
Horsetail - Spore } prothallus - male
prothallus - female

Little Club Moss } macrosporangium female
microsporangium male

Vascular Cryptogams } Ferns
Horsetails
Club mosses

are sporophytes or spore plants.

ilp 48 cmc 147



Good but no key

May 29th

ilp49 cmc147

Sweet Vernal Grass.

Differs from ~~other grasses~~ as it has proper flowers - staminate & pistillate in one

Inflouescence - spike Stem is jointed at nodes.
Leaves - linear, sessile, sheathing the stem.
Inflorescence - spike

Meadow Foxtail, & Wood Melick have many flowers in a spikelet (divisions on the spike) The vernal grass has only one flower in a spikelet.

also Common Bent & Reed Grass

Qura "Yorkshire Fog" have 2 flowers in a spikelet
Grass grows quickly at internodes which are
sometimes hollow - cane & bamboo.

Edible grass seeds - oats, barley, corn, wheat etc

Nearly all grasses have 3 stamens & 2 stigmas.
Sweet Vernal Grass has 2 stamens & 2 stigmas.

Inner & outer leaves of spikelet = flowering glumes & pales. Awns - little bristles

Ownless

Owned

Poas.

Fescue

Yorkshire Fog.

Fortail

Common Bent

Sweet Vernal Grass.

Reed Grass

False Bat

Dog's Tail

Aira

Wood Melick

Meadow Fescue, meadow Foxtail, Dog's Tail, Rye grass, Cockfoot & Timothy are all useful

Silica or flint stiffens the stems of some grasses - So when they are beaten down by rain etc. they are able to erect themselves by means of their nodes at which they can bend at right angles

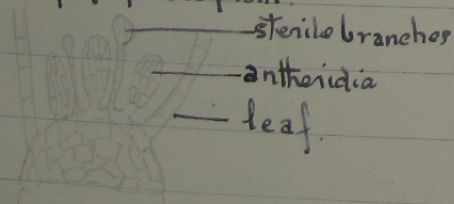
R

June 5th Mosses

Grow in various places - rocks, barks of trees, running water etc. Those in running water are in long strands. Mosses grow in two ways - straight up & creeping: top fruiting or Acrocarpous; side fruiting or Pleurocarpous.

Roots of mosses are called rhizoids. Moss leaves have no epidermis. They are small & closely set, & the water runs up them. The leafy moss plant corresponds to the prothallus stage in a fern, & it produces antheridia & archegonia (sperms & egg cells).

Section of tip of male plant.



The alternate generation consists of the seta (stem) & capsule. The capsule has 3 coverings:-

1. veil or calyptra - seed coat, archegonia
2. lid or operculum
3. peristome - teeth - single or double row.

When the moss ripens, first of all the veil falls off & discloses the lid. The teeth regulate the scattering of the spores - closing in damp weather as the spores stick together & standing up in dry weather as the spores are as dust.

The Polytrichum (polus - many, tricha - hairs) & its relations have a white membrane connecting the its teeth.

Names of Mosses

Crimmia	} Tringe mosses
Racomitrium	
Tunaria	Cord or Screw Moss
Tortula	Screw moss
Bryum	Thread Mosses
Mnium	Thyme thread mosses
Polytrichum	Hair (or star) Moss
Fissidens	Hat fork moss
Ceratodon	Fork moss

ilp52cmc147

Dicranum
Hypnum

Broomfork moss
feather mosses.

The moss spore produces the protonema. ^{because it bears several moss buds.} not a prothallus.

Kinds of mosses:-

- i. Sphagnales.
- ii. Andreales (4)
- iii. Bryophales or urn mosses.

(a) membrane

(b) single layer

(c) double layer - acrocarpous or pleurocarpous.

June 12th

Bryophytes { Mosses
Liverworts.

In order not to confuse mosses with liverworts, the liverworts are divided into classes: ~~also, it is~~

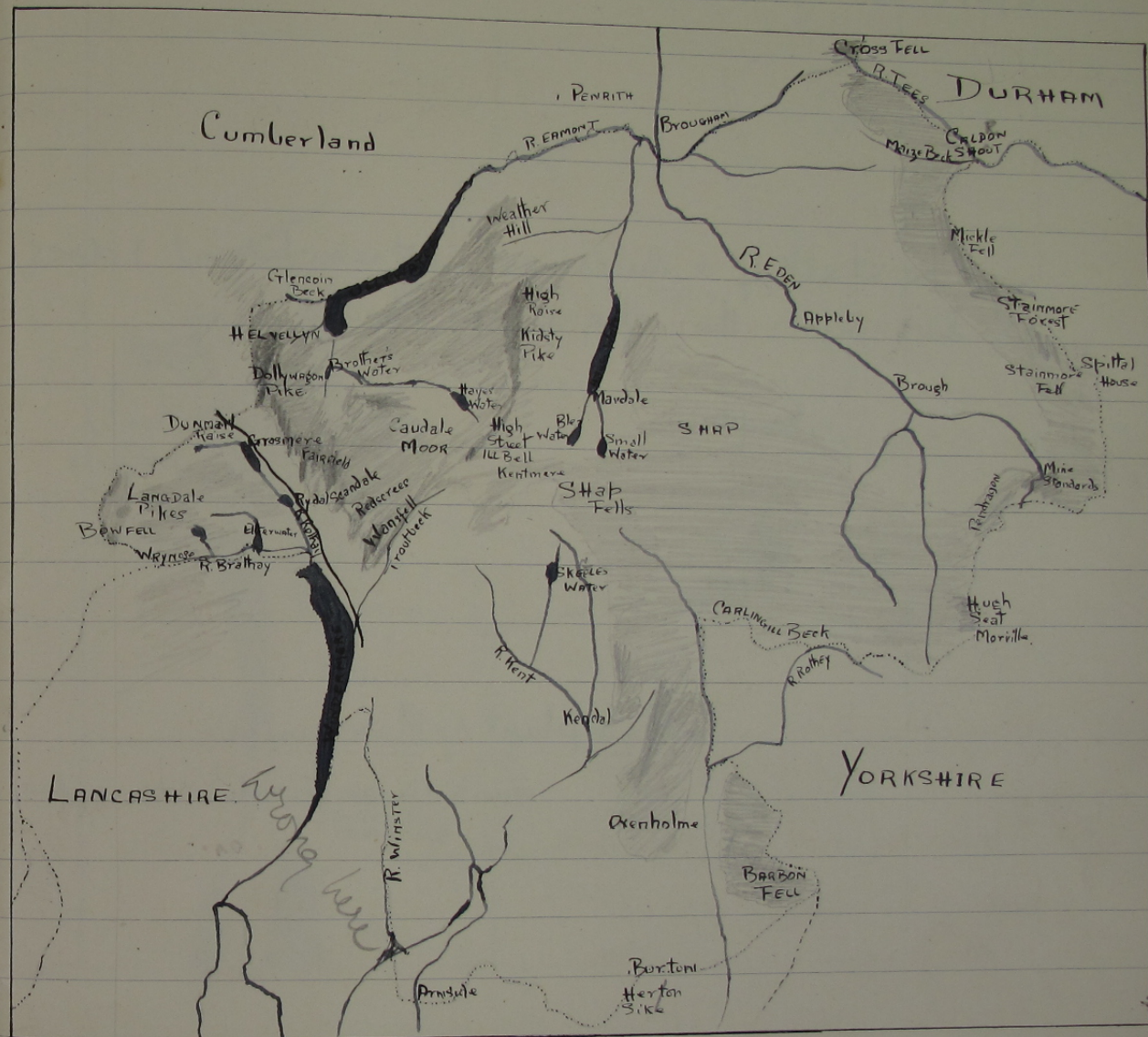
Frondose Liverworts

Foliose liverworts: - arrangement of leaves. Mosses are (very) difficult to press owing to the spiral arrangement of their leaves. In liverworts, the leaves lie right & left. The capsule splits into

ilp53cmc147

The BOUNDARIES of WESTMORLAND.

JUNE 10th



Good on the whole

four; & the spores are mixed with the elaters.

ilp 54 cmc 147

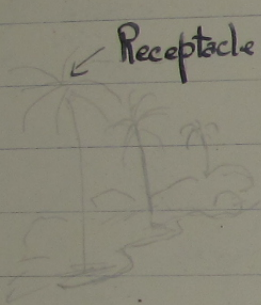
The one exception in the mosses whose capsule splits into four is the *Andriaca petrophila*.

:-

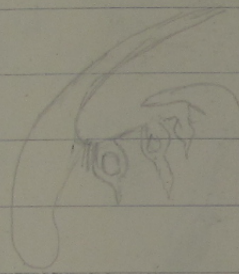


The stalk of a liverwort is transparent & does not live after the spores are shed.

← Receptacle

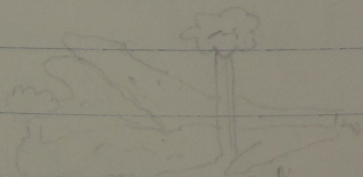
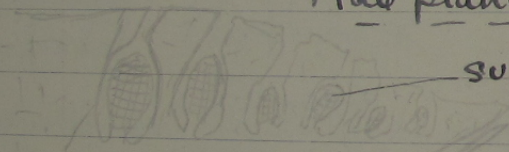


one arm of
receptacle
bearing
archegonia.



Male plant of Marchantia.

sunken antheridia on upper
surface



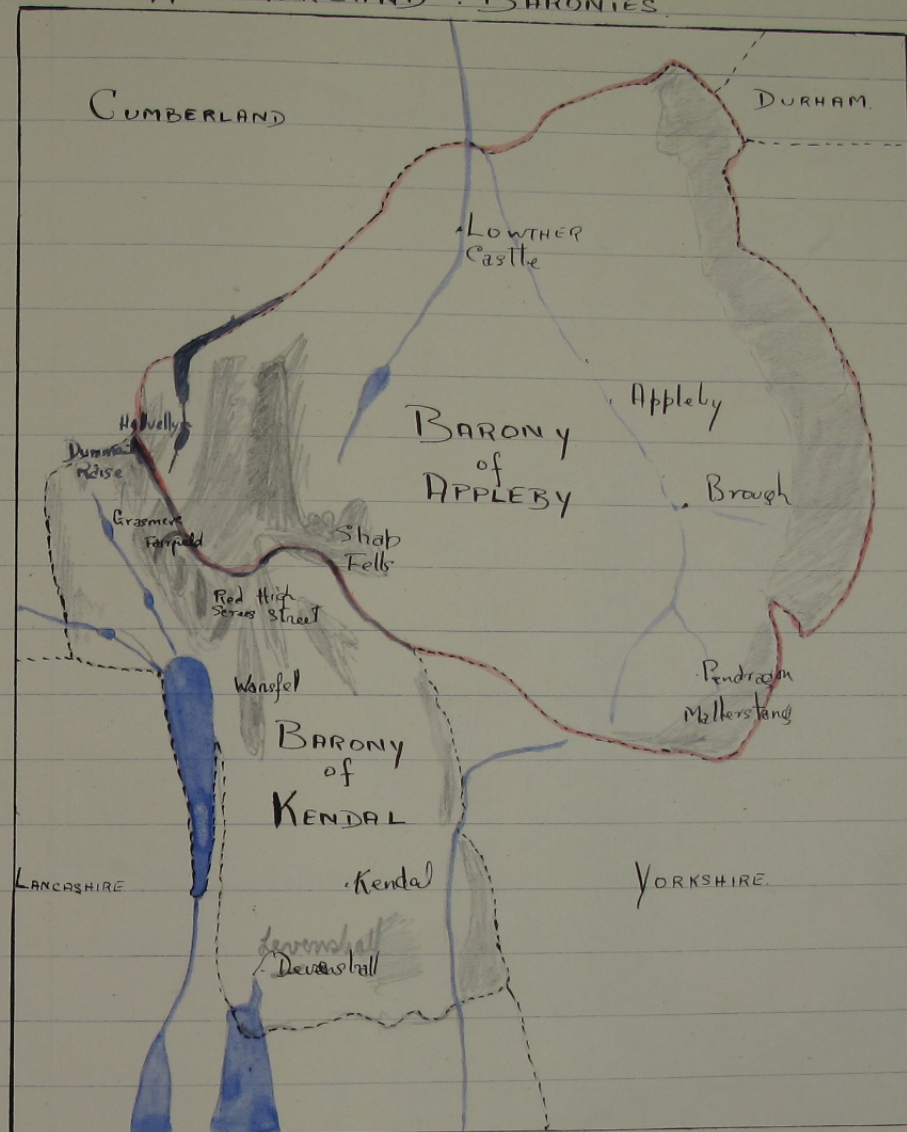
male plant of *Marchantia* bearing
antheridial receptacles

Good

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June 17th

WESTMORLAND : BARONIES

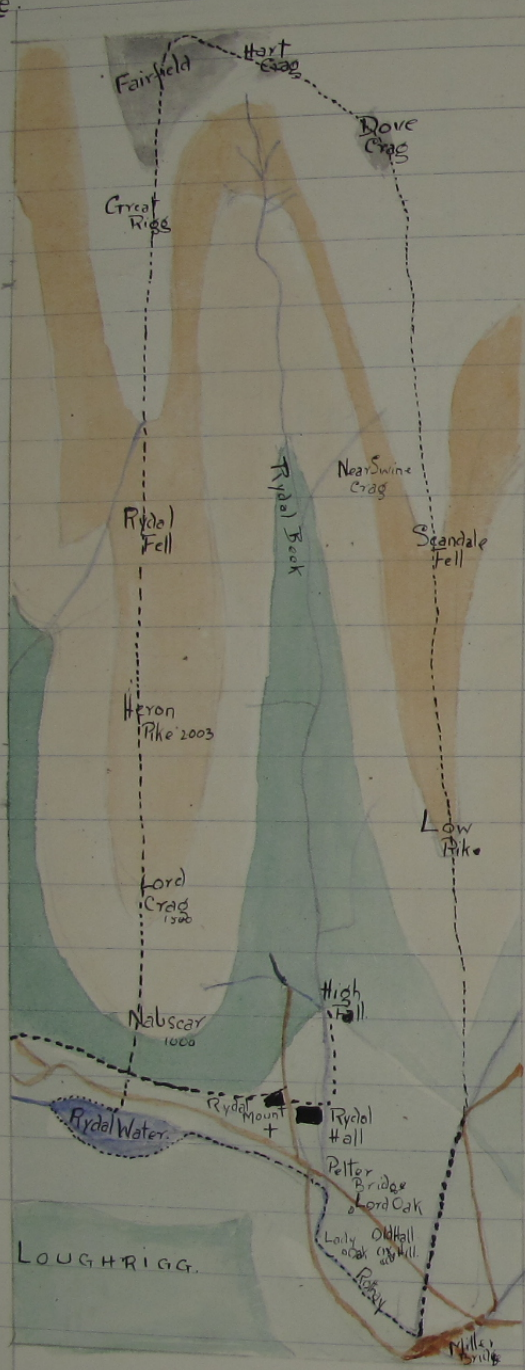


Fair

Manor
Rydol Estate

ilp 56 cmc 147

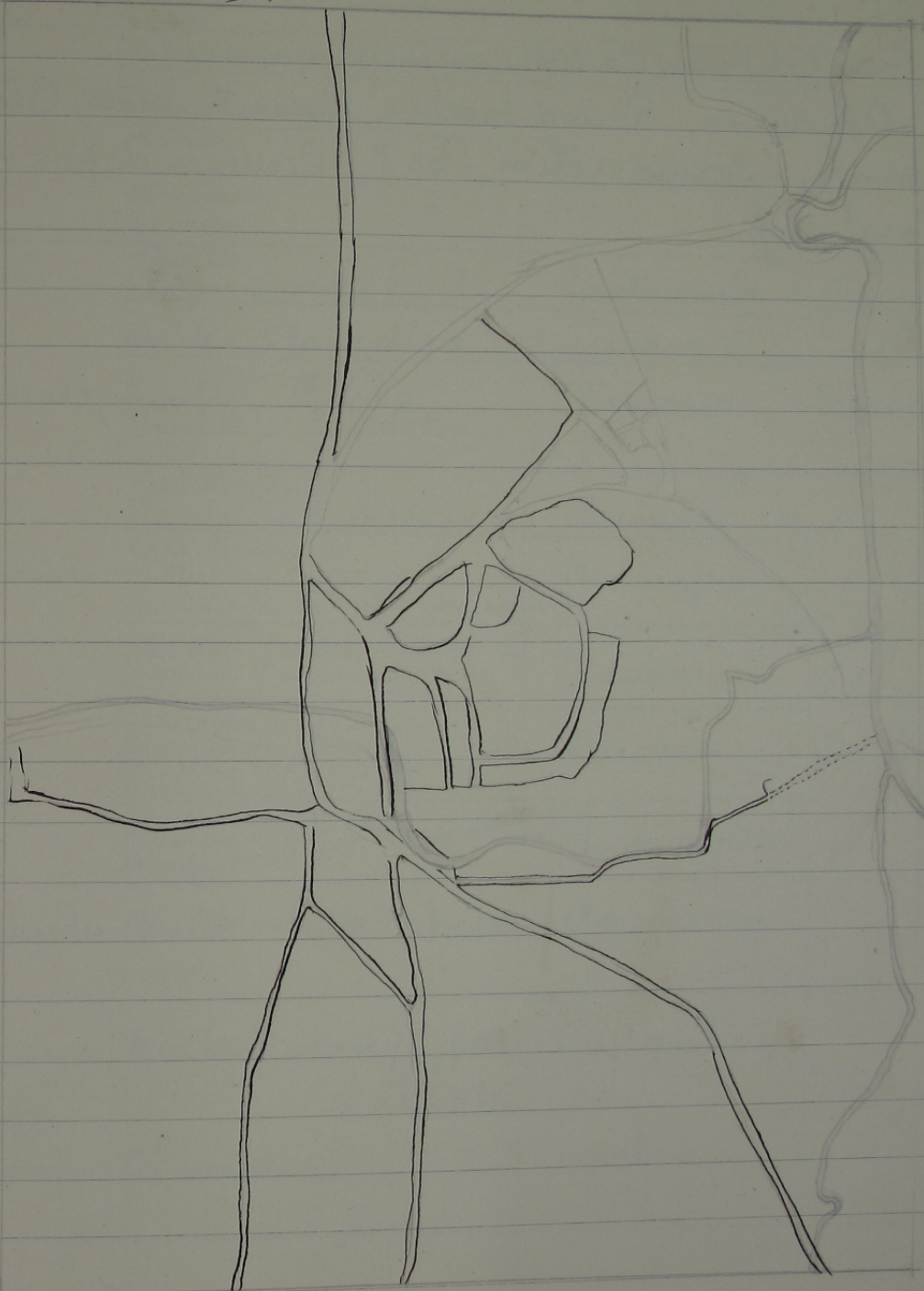
June 23rd



Good

AMBLESIDE

ilp 57 cmc 147



You ought to have spent an hour over your map. If you had there would have been names on it, surely.

ilp 58 cmc 147

Recent deposits (Those now in progress)
Alluvium, Raised beaches, River terraces, Blown sand, Volcanic action, Peat, Cavern deposits, Coral reefs.

Geology. ilp 59 cmc 147 Winter Term 1922

Appearance of Life	Systems.	Groups	Periods.
	Deposits in progress (recent)	Post Tertiary	
Man	Pleistocene Pliocene Miocene Oligocene Eocene	Tertiary	Cainozoic
Birds	Chalk Greensand & Gault Oolites, Clays, Lias	Cretaceous Jurassic	Mesozoic or
Mammals	Keuper, Marls Bunter Sandstone (and Red Sandstone?)	Triassic	Secondary
Reptiles.	Red Marls Magnesian Limestone	Permian	
Amphibians	Coal Measures Millstone Grit Carboniferous or Mountain Limestone	Carboniferous	
	Old Red Sandstone in most of England. Marine rocks in Devonshire	Devonian	Paleozoic or
Fishes	Kirby Moor Flags Balmisdale Slates Conistone Grits & Flags Stockdale Shales Conistone Limestone Volcanic Series of Bowland Shiddaw Slates	Silurian Ordovician	Primary
Invertebrates only	Grits, slates & shales	Cambrian	
"The Dawn of Life." (Region)	Rocks of many types Schists Gneisses	Pre-Cambrian or Archaean	Eozoic.

ilp 60 cmc 147

New Red Sandstone Oct. 17th

New Red Sandstone is found on top of the Carboniferous rocks.

Buildings - Carlisle, New Liverpool Cathedral.

R

Natural History (other end) Elements. Oct. 23rd

There are about 80 elements. Knowing the properties of the elements does not help us to know the properties of the compounds they form.

Atom from the Greek α = not, $\tau\epsilon\mu\epsilon\sigma$ = cut - something which cannot be divided. The smallest thing that the naked eye cannot see is $\frac{1}{100}$ inch all ways. 3 or 4 million atoms could be placed in a line $\frac{1}{100}$ long.

Molecule (moles - a heap \therefore little heap) - the smallest ^{position of a} compound that is possible e.g. a molecule of water (H_2O) is made up of 2 atoms of Hydrogen & one of Oxygen. ^{which makes them combine} This is chemical affinity - as far as the

ilp 61 cmc 147

Scientists of today ~~it~~ can tell, whether the force that is 'electrical attraction', is the same.

An atom is today known to be many, many particles revolving round each other like a miniature solar system or star with its innumerable smaller stars, revolving round it & giving the effect of one whole ~~will be~~.

N_2O = laughing gas. $NaCl$ = salt.

<u>C</u>	<u>H</u>	<u>O</u>	
12	22	11	= sugar
6	10	11	= starch
2	6	1	= alcohol
3	8	3	= Glycerine
3	5	9 + 15	= Nitro-glycerine

A molecule may be composed of 2 atoms of the same kind - e.g. two atoms of C. gold. etc. As long as there are more than one atom present it is a molecule.

There are three states of matter & they depend upon the ^(cohesion - i.e. stick-2.) cohesion of the atoms. They are: Solid - liquid - gaseous.

coheres

ilp62cmc147

Molecules of iron vibrate if the bar is hammered. It so becomes hot i.e. the molecules part; & we may join the broken bar & leave it to cool - i.e. the molecules again cling to each other. All solids are porous - they are composed of masses of vibrating molecules. Good

Geology

Oct. 24th

Colites } Jurassic.
Lias }

oon (qn) = an egg, lithos = a stone
The name Lias is given to the lower layers of rock.

Some stones of the Jurassic age very much resemble marble e.g. Purbeck, Portland & Bath Stone are limestones valuable for building.

William Smith 1790 - "father of Eng. geology."
learned to tell kind of rock by fossils.

Some animals of the Jurassic age were the Plesiosaurs, Ichthyosaurs, Pterodactyls & Megalosaurus. The Archaeopteryx was the earliest birds with feathers, wings,

ilp63cmc147

a jointed tail & teeth

Lias rocks are generally blue. There may have been a 'Sargasso sea' of sea-weed which would naturally stain them; or they may have been washed off from the coal measures. Good

Oct. 31st

Chalk - North & South downs. Weald is the wearing away of the top of an anticline. Also found on Salisbury plain & an arm goes to the North West going out to the sea at Hunstanton, & also at Flamborough Head.

(White Horse at Westbury, Wilmington Man. Salisbury Plain bare etc.)

Chalk rocks originally under sea.

Tertiary rocks or sands come on top of the chalk. The Thames basin & Hampshire basin (Pocene & Oligocene) The Pliocene up coasts of Norfolk & Suffolk. There are no Miocene ^{strata} in England.

ilp 65cm 147

pleistocene - more (recent forms fossils)
 Pleistocene
 Miocene - less (")
 Miocene
 Oligocene - few
 Oligocene
 Eocene - dawn, kainos : recent
 Eocene
 From Eocene & upwards - dawn of recent life
 discovery.

[Chalk composed of millions of minute particles
 of Globigerina]

Tertiary - gravel such as London common
 & Heaths & those of Hampshire - Aldershot etc.
 New Forest to Poole & Lulworth

Stafford - Fingals Cave & Giants Causeway
 - sheets of volcanic rocks of Tertiary age

Nov. 14th

Signs of erosion { U-shaped valleys & hanging valleys
 { Roches moutonnées (rounded) & ice scratches
 & of blocs perchés & erratics (both ^{called} boulders)
 deposition

Moraines : terminal

lateral & median
 a ground - boulder clay. = Till (very clayey)

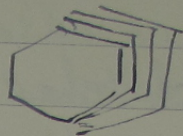
Minerals

Crystals

ilp 65cm 147

Dec. 5th

Mica



Fluor spar

Quartz

Calcite, rhomb-shaped. Has a good
 cleavage - breaks into smaller pieces of
 same shape.

Minerals are classified into degrees of
 hardness - into ten degrees: -

1. Talc.
2. Gypsum.
3. Calcite.
4. Fluor spar
5. Apatite.
6. Felspar
7. Quartz
8. Topaz
9. Corundum.
10. Diamond

A softer mineral can be ^{scratched} only by a
 harder one. : Quartz will scratch Calcite, but not

i/p 68 cme 147
Feb: 6th '23.

We see planets by means of reflected light from the sun & are much nearer to us than other suns.

Proper motion of Stars.

The nearest star has appeared to move $\frac{1}{2}$ the diameter of the moon in 200 years. Stars are travelling very quickly but they are so very far away from us that it makes no difference to us - e.g. the stars in the Great Bear are some rushing one way & some another & yet we see not the slightest difference from night to night & year to year.

Some stars are travelling at the rate of 100 m.p.s. Our sun is rushing towards Lira at 25,000 m.p.h. It has been discovered that stars rush in one of 2 opposite directions. There is a star in the Great Bear called the Runaway Star or 1830 Groombridge, a star of the 6th magnitude which is

i/p 69 cme 147

supposed to be travelling at the tremendous rate of 138 m.p.s. Vega & Sirius are coming towards us from opposite directions at 10 m.p.s. & Capella at 15 m.p.s. Castor & Pollux. Castor is receding at $4\frac{1}{2}$ m.p.s. & Pollux is advancing at 33 m.p.s. & yet we see no difference.

Size of Stars.

This is determined by means of the Spectroscope - by finding the amount of light given together with the distance.

Magnitude - This is the size a star appears to be to us - its brightness. There are about 20 stars classed together in the 1st magnitude & each successive magnitude contains about $\frac{2}{3}$ the brightness of the preceding magnitude. Thus - 1st magnitude contains 20 stars

2 nd	65
3 rd	190
4 th	425
5 th	1500
6 th	3200

Stars of the 16th magnitude are about the limit of those which can be seen with the most powerful telescope. Vega, Capella & Sirius are stars of the 1st magnitude. Sirius is 2½ times as bright as any other ^{good}.

Feb. 13th

Spectrum Analysis

By means of the spectroscope many things can be discovered. e.g. the temperature of the stars; the elements of which they are composed; the rate & also direction of travelling. The method of discovering the elements is this: gases in an incandescent state show dark lines on the spectrum. The arrangement of these dark lines indicates the presence of certain elements.

Variable Stars

Algol is the chief variable star

Feb. 23rd '23,

Temporary Stars.

Temporary stars are those which appear for a time & then disappear again. Two causes are put forward: 1. by the collision of heavenly bodies ^{dark} they ~~become~~ light is made; & 2. they become luminous by friction from rushing through ^{a nebula} the atmosphere.

1572.

The most famous temporary star appeared in Cassiopeia in 1572. This was as bright as Venus in its greatest magnitude. It was first red & became afterwards like lead, like Saturn. This star lasted for two years & then disappeared.

1866.

One in Corona Borealis of 2nd magnitude for about 2 days when it dropped to the 9th. It still is that now & therefore invisible to the naked eye.

1892.

A yellow one in Auriga. Began in 15th magnitude & increased in size, but disappeared by August.

1901.

One of the first magnitude in Perseus. This was in February. After 2 days it lost a third of its brightness & varied between the 3rd & 5th magnitude for 6 months & then disappeared.

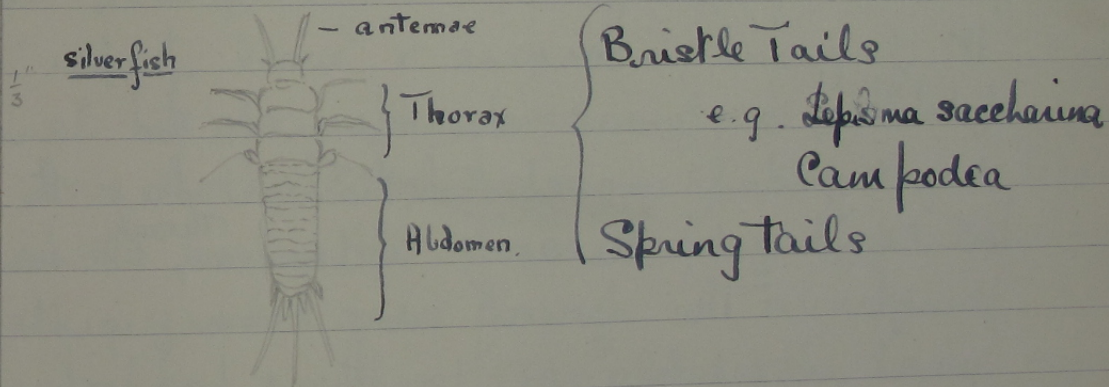
Binary & Multiple Stars.

Cassini discovered a great many of these stars. There are now over 12,000 known binary stars. - Binary stars are two stars so close together that they appear as one. ✓

Summer Term 1923.

British Insects.

1. Silver-Fish. (*Lepisma saccharina*) one of the Bristle tails (λεπίς = a scale)
^{Sub.} Order: Thysanura. Order: Aptera = without wings.
 Consist of 14 parts - 1 in head 3 in Thorax, 10 in abdomen. True insects have 3 pairs of legs (from Thorax). Silvery scales. Called Bristle tail because tail has 7 bristles three being longer than the other four.



head - antennae, eyes, jaws } segmented
 thorax - 3 pr. legs } body.
 abdomen }

ilp 74 cmc 147

Mouth parts of cockroach.

Labrum (upper lip)

Mandibles

1 pr. maxillae

2nd pr. "

Labium. (lower lip).

The Silver fish is like the larvae of the higher insects & it is thought that it is ^{also like} the probable ancestor of all insects, one reason for this belief being that the earliest insects ^{probably} had no wings at first, but grew them gradually.

The Silver fish is about $\frac{1}{3}$ " or $\frac{1}{4}$ " long. It frequents corners & wall paper & seems to have a great aversion to the dark. It is a typical insect in that it has the three parts head, thorax & abdomen, ^{though} it has no wings. The young are born with a great resemblance to their parents; during their life, they do not undergo very much change. They belong to the lowest class of insects, which changes the least in its attainment of perfection. Fairly good.

May 7th

Neuroptera

ilp 75 cmc 147

νευρον = a nerve

Alder fly
lace-winged fly.

may flies
dragon flies
stone flies

Caddis flies

Scorpion flies.

The may fly lives only a short time above the water, the aim of its winged life being only to form & lay eggs. The may grub goes through a number of moults & when it is ready to come out of the water - having lived underneath about two years - it crawls up some water plant & after a few hours, is ready to flit ^{above} among the ^{stream} green until it

ilp 76 cmc 147

has laid its eggs, & then it dies.

The Caddis fly builds for itself a tube of little bits of twigs or sands & stones & lives in this during the underwater period of its life & this ^{grub} fly differs from the May grub in having a 'resting period' or chrysalis stage. About a fortnight before emerging, he closes the ends of his tube with silk & remains like that for a while so that water may get in but not other grubs. It then emerges from the water. It is rather larger than the May fly.

The Dragon fly is different from either the May fly or the Caddis fly in that it catches food both under & over the water. It is a very greedy fly! The larva gets food with his 'lip' - a mask over his face which is extended to catch a grub & brought back again to its mouth.

Good

chrysalis larvae is plural.
chrysalis
chrysalis.

ilp 77 cmc 147

May 21st 1923

Coleoptera

Kolikos = a sheath pteron = wing.

(elytra. - false wings or sheaths)

Beetles. have three stages in their life:
grubs or maggots (larvae)
pupae
beetles

Larvae.

	Campodeiform	or	eruciform
e.g.	ground beetle		(eruca = a caterpillar)
	carnivorous water beetle		tiger beetle
			cock chafer.

The female cock chafer burrowed down in the earth & laid about 30 or 40 eggs ^{from} which, after about five weeks, ^{hatched} were turned into tiny white grubs which stayed underground for three years feeding on the roots of any neighbouring plants. Then it spun a little cocoon for a resting stage (or pupa) in which it

X The report having described grubs in the plural hitherto now uses the singular.

ilp78cmc147

remained for 6 or 9 months. Then it emerged the full-grown cockchafer. Once ^{it} has his ^{its} wings, a cockchafer can not grow larger. If the grub is small, so will be the beetle, & if the grub is small, the beetle will be correspondingly small.

Pl. sort but you must take pains every with Nat. Hist. to use the same number & grades throughout.

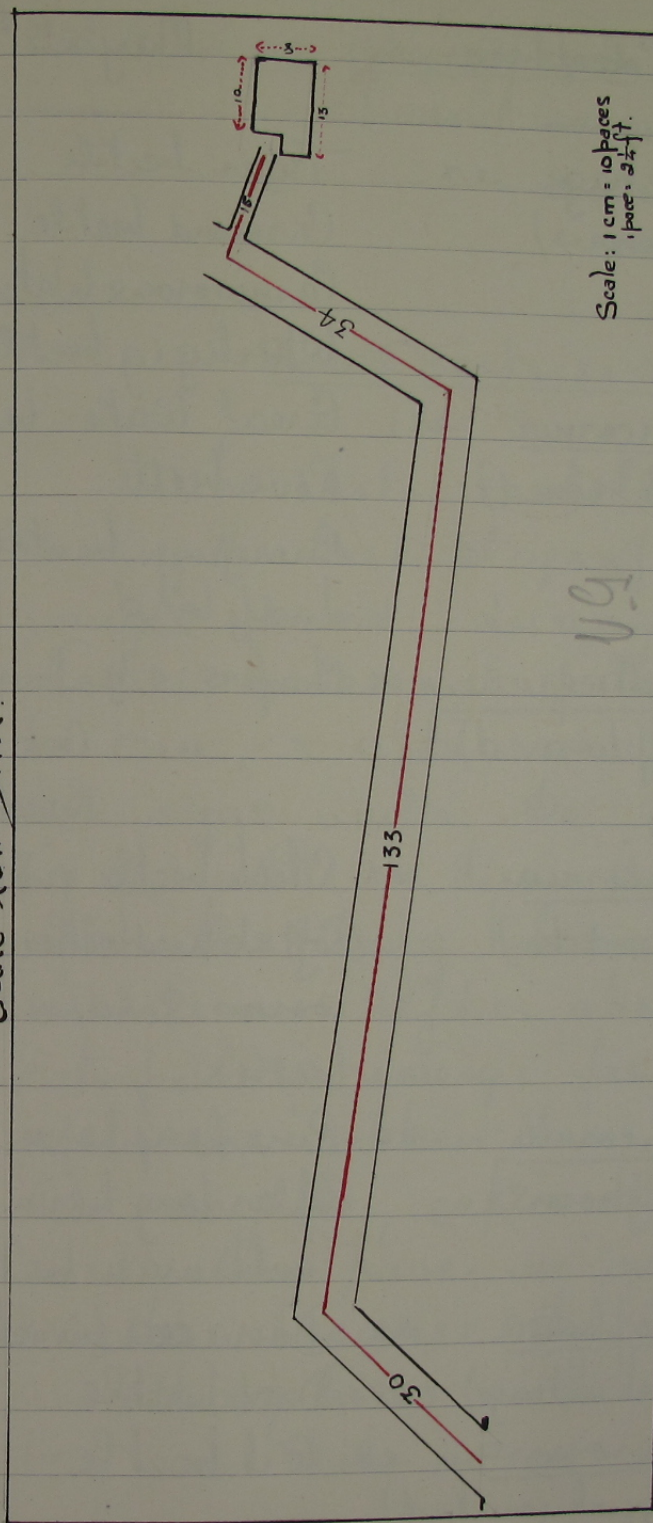
Geography

Geography gives 2 notions: distance & direction. Direction we may judge roughly only by sunset & sunrise; but more accurately by measuring shadows before & after noon. by the pole star; & by a watch. (place hour hand to sun, & S. = $\frac{1}{2}$ way between hour hand & sun)

Distance we may gauge by pacing or measuring. The most convenient is pacing.

ilp79cmc147

Scale How Drive.



Scale: 1 cm = 10 paces
1 pace = 2 1/4 ft.

May 26th 1923.

ilp 80 cmc 147

Coleoptera.

May 28th '23

- Sub-order I Adephaga ex: Tiger beetle
(ravenous) Ground beetle
Carnivorous Water beetle
Whirligig beetle
- .. II Clavicornia ex: Great Water beetle
(club-horned) Rove beetle
Burying beetle
Lady bird
- .. III Lamellicornia ex: Chafers: e.g. Dung or Dor beetle
(leaf-horned) Cock-chaffer
Bracken Cuck
- .. IV Sericornia ex: Click beetle or Skip Jack
(saw-like) Softskinned beetles eg Glow
worms. Soldier & sailor
beetles.
- .. V Longicornia ex: Pine long horn
(longhorns) Poplar long horn
Timberman beetle
- .. VI Phytophaga ex: Donacia (in water plants)
(plant-eating) Dock beetle.
- .. VII Heteromera ex: Oil beetle
(unequal-jointed)

ilp 81 cmc 147

Sub-Order VIII Rhynco^{ph}phora ex: Weevils eg Phyllobius
(snout bearers). Fig-worm beetle
Bark beetle
(Scolytus)

Small Tortoise-shell Butterfly.

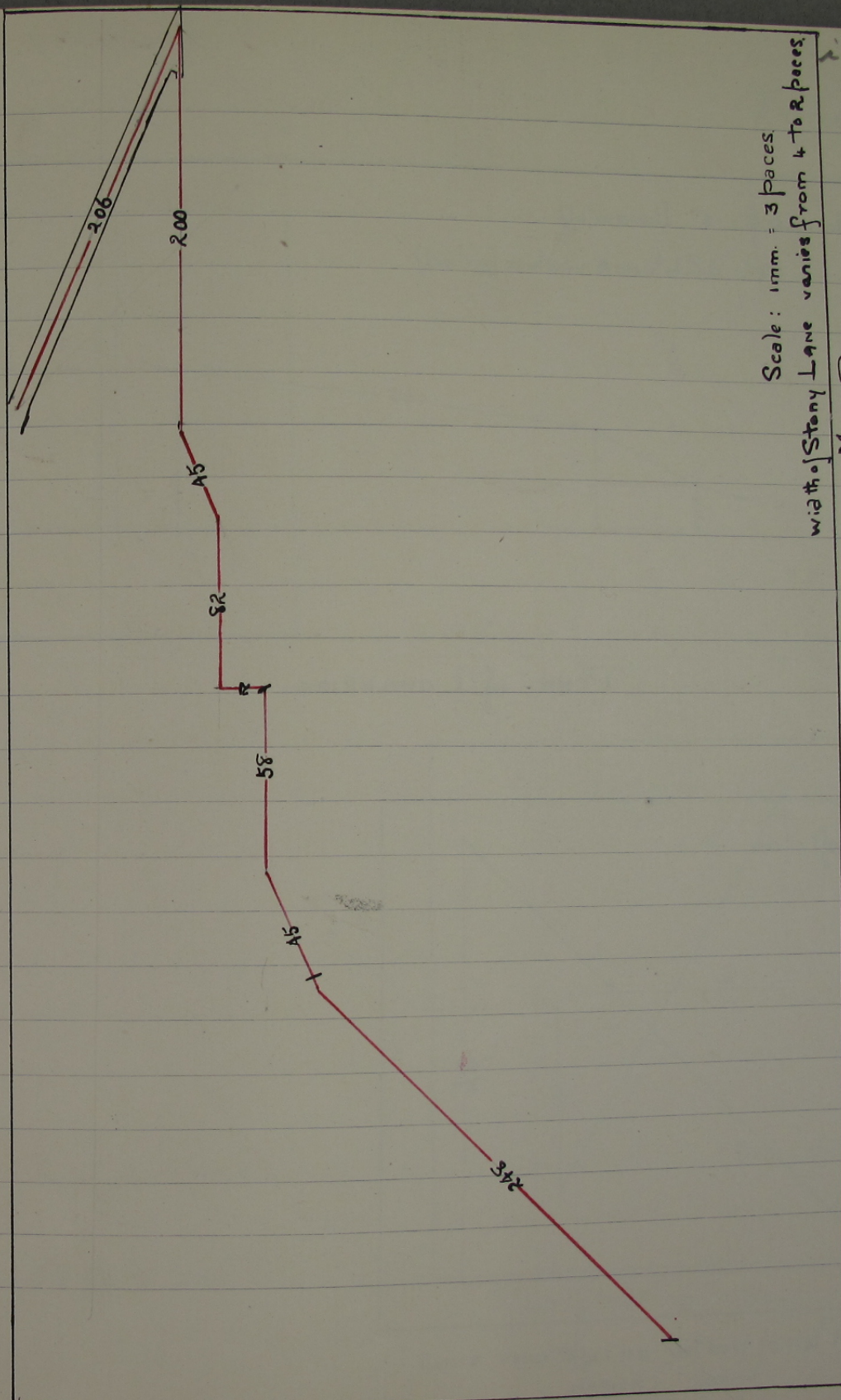
The Tortoise shell butterfly hibernates during the last stage of her life - i.e. the winged period, during the winter. The mother comes out of her hole in the wall or tree, & after a short flight, lays her eggs under the fresh green leaves of the nettle & then she dies. - Her wings after this long hibernation are faded & colourless. After about two weeks the caterpillars emerge from their eggs & spin a 'silken tent' on some leaf. All day they eat & at night return for rest; they have no need to pause for breath because they have spiracles or breathing holes in their sides by which they can take in air. They eat so much

21p82cm/147

that their skins fit tightly & so, contracting their muscles, they split their skins. This happens five times & just before the last moult is shed we may see the butterfly forming within & now there comes the resting stage during which changes in the mouth & nerves take place. The nerve system, formerly stretching throughout the body, now concentrates on the head, for the use of the large eyes of the butterfly. The chrysalis hangs downwards by means of cushion feet which are really folds in the skin. There are 3 or 4 hairs of true feet close to the head.

Geography.

We also tell direction by the compass.



ROAD FROM SCALE HOW GATES & STONY LANE TO MILLER BRIDGE.

Excellent

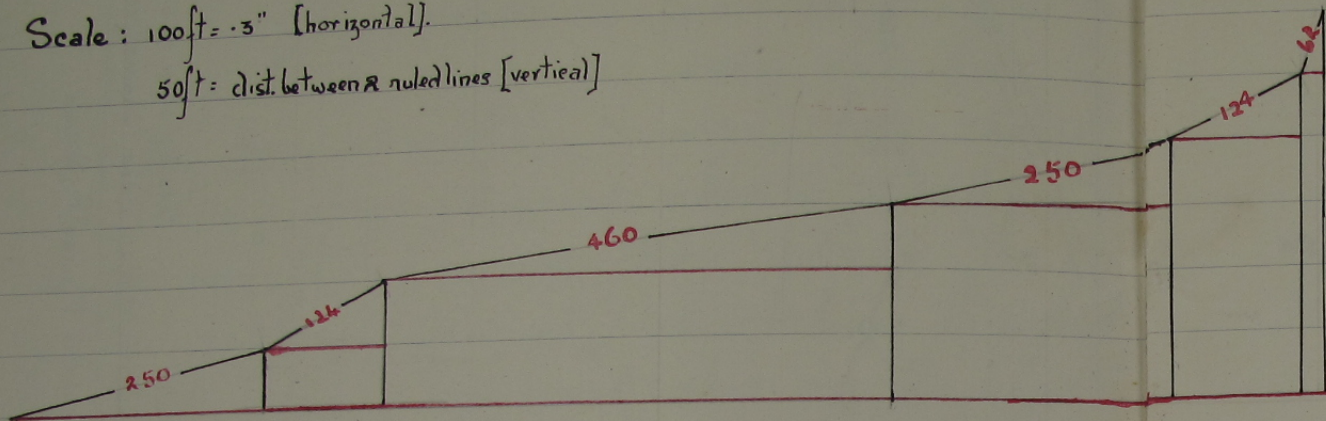
21p83cm/147

21 p 84 em 147

June 9th '23.

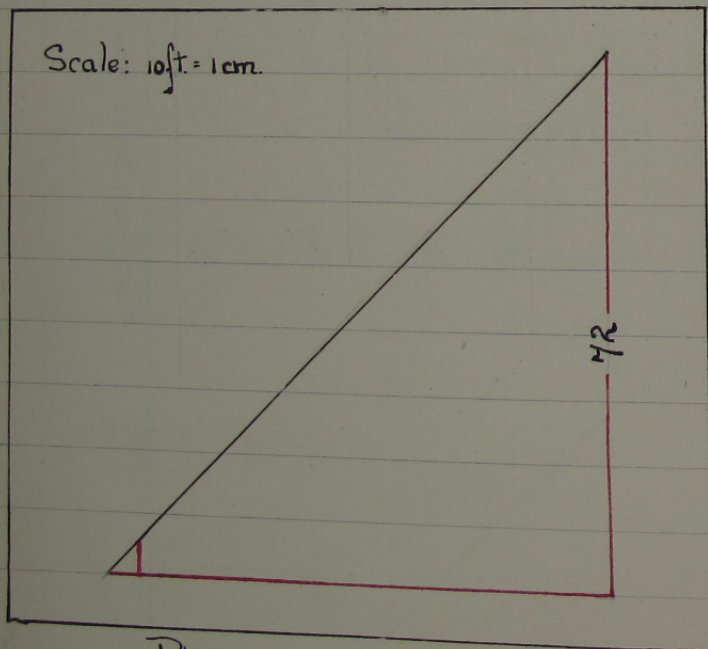
Scale: 100 ft = .3" [horizontal].

50 ft = dist. between 2 ruled lines [vertical]



PLAN of LOUGH RIGG.

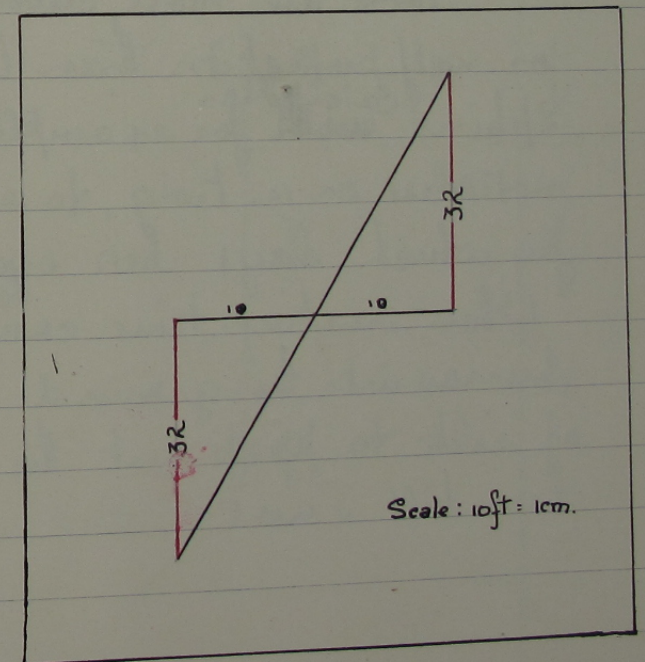
Scale: 10 ft = 1 cm.



Plan of pine tree on right over small bridge. - Height.

Excellent

Scale: 10 ft = 1 cm.



Plan of width of Rothay.

alp 85 emc 147

Lepididoptera

18715 = a scale -

June 11th

Proboscis - 1st pair of maxillae

Butterflies

Club-shaped antennae

fold wings

waist

fly in day-time.

wings not linked

Moths

feathered, etc.

different position.

broad body

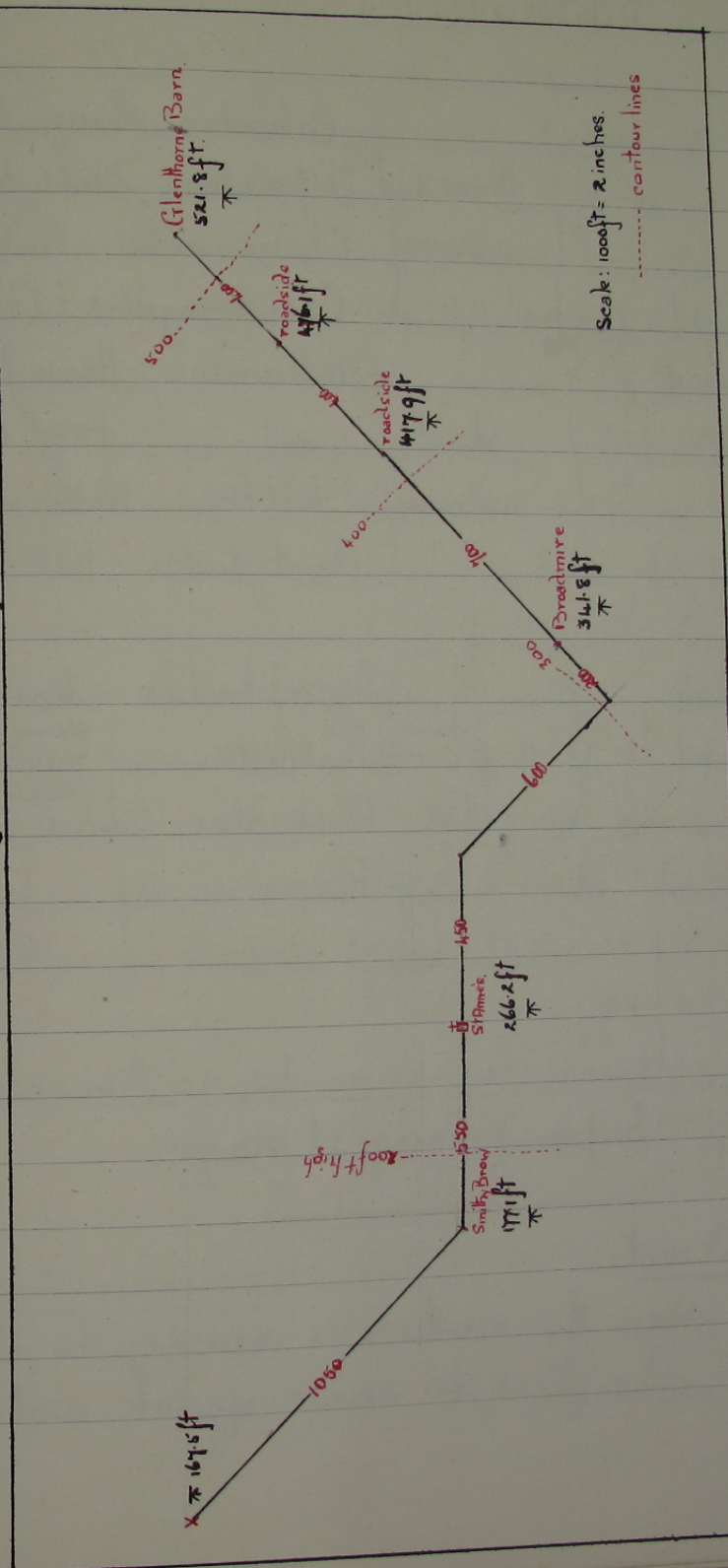
fly at night.

wings linked by a
hook & loop.

Moths are more clever in their devices
for self-protection than butterflies. The
Sphinx ^{caterpillar} ~~moth~~ for example, will lie for hours
motionless on a twig, to escape the ichneumon
fly which lays her eggs in the caterpillar.
When resting-time comes, the caterpillars
burrow into the ground & weave a nest
of silk to keep out the web; they remain
here till June. Good but ill written

alp 86 emc 147

Plan showing Bench marks from Chapel to Glenhorne Barn.



Excellent

Diptera.

Straight
seamed
flies

 {

 Thread-like antennae {

 Culicidae : Mosquitoes & Gnats.

 Tipulidae : "Daddy long legs" or Crane flies.

 Chironomidae : Midges

 Cecidomyidae : Gall midges

 short antennae {

 Tabanidae : Horse flies e.g. leg & great or gad-fly.

 Asilidae : Robber flies e.g. Empis

 Bombyliidae : bee fly.

Circular
Seamed
Flies

 {

 Typical flies {

 Syrphidae : Hover flies.

 Muscidae { house flies

 Blow flies

 Flesh flies e.g. Lepto

 Cestridae : Gad & Bot flies

 Fleas

This ... egg
 larva - legless grubs, no thoracic legs
 pupa - longest stage.

The Gnat.

When the mother is ready to lay her eggs, she flies to some quiet water, gathers

her eggs together into a boat shaped mass with her long hind legs & deposits them on the water. Soon the eggs are hatched & the young grubs swim about, using some tufts of hair growing round their mouths to whirl microscopic animals & plants into their mouths. They swim head downwards & tail upwards, because they breathe through a small tube at the end of their tail which they put above water to take in air. During about a fortnight they shed their skins three times & after the fourth time they are shorker & unable to eat but still swim about. Also a curious change has taken place, the tail tube has disappeared & two tiny tubes have formed on their backs.

Good

Geography Report. June 29th '23

Lake Windermere

Lakes may be formed by basins of rock (formed) scooped out by glaciers, or by

ice forming a dam across a river bed. Windermere was ^{made} formed in the former way. The upper part consists of one rock basin, as far as the islands opposite Bowness. If the land here were raised 12 ft. we should be able to walk across on dry land! The deepest part of this rock basin is 219 ft., just opposite Wray. The ^{lower part} of Windermere consists of 2 rock basins, the deepest part of the first being 100 y of the second 128 ft. The second is made deeper by the ^{glacial drift} ice damming up at the foot - This dam also prevents the water from running straight out, as the lie of the country would permit, but causes it to turn & run down another valley.

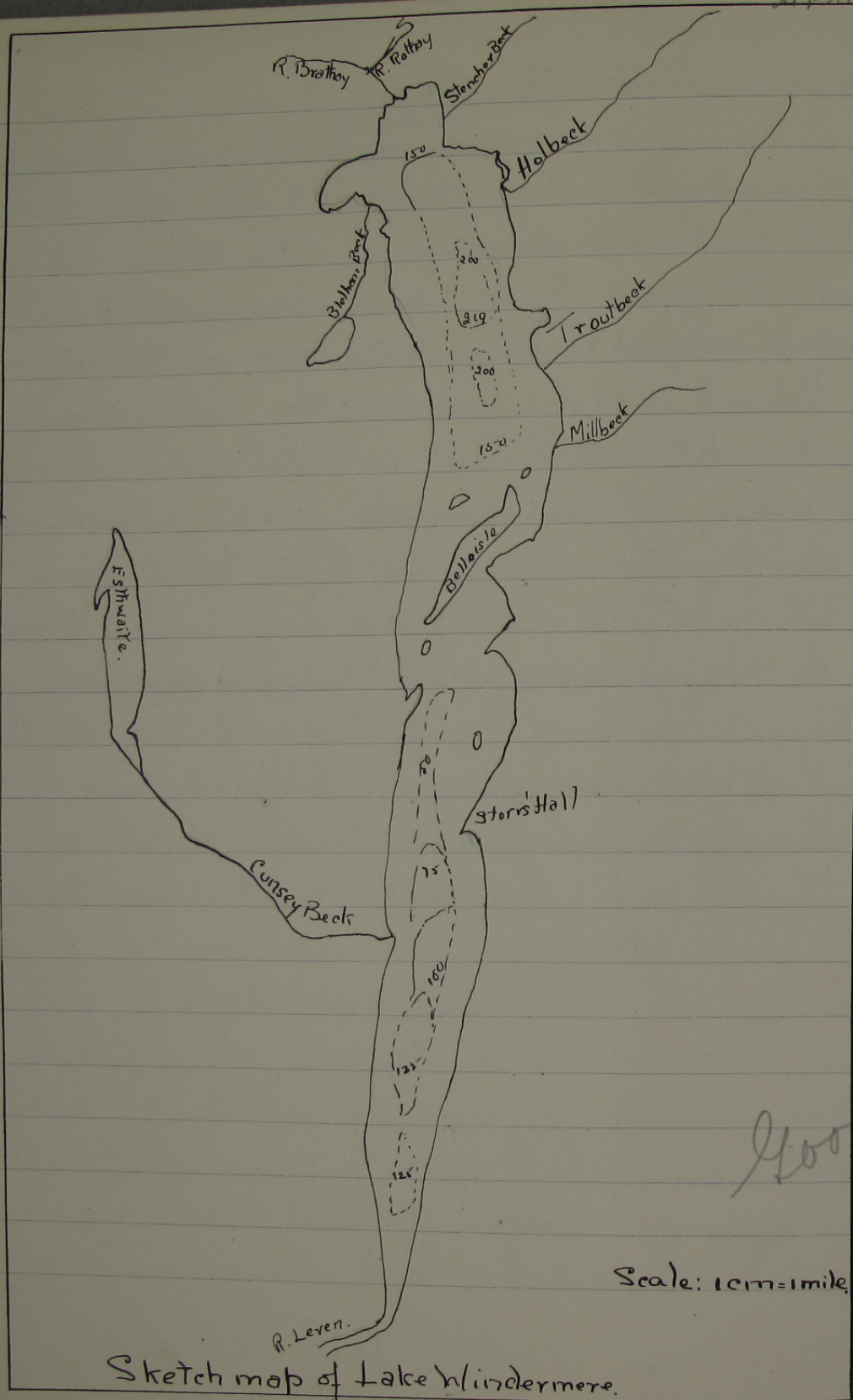
Windermere is called the 'River Lake'. It is of such even shape all the way down, that it might almost be a drowned river bed. But the absence of bays formed by tributaries denies this & also the large rock basins. There is only one drowned river bed & that is Pull Beck, which

forms Pull Wike Bay.

Windermere is the largest lake in England. It is $10\frac{1}{2}$ miles in length & the breadth varies from $\frac{1}{4}$ - $1\frac{1}{4}$ miles. At no place is it more than a mile wide if taken at rt angles to the axis, but at Pull Wike Bay looking across to just above where the Holbeck runs into the lake it is $1\frac{1}{4}$ miles wide. The surface is 128 ft above sea level. The average depth is 78.5 ft. In area it is ~~5~~ 5.69 square miles; & it drains the large area of 88 square miles.

Some of the tributaries are Brathay, Pullbeck, one from Belleham tarn, Cunsey Beck (from Esthwaite) Millbeck, Troutbeck, Holbeck & Skencher Beck.

V.G.



1923.

Hymenoptera

ip92cm147

July 2nd

{ Saw flies
Wood borers

Gall wasps

Ichneumonans

Bumblers: Cerceris, Sphex, Sand wasps

Wasps solitary & social

Bees

✓ Ants